The MINING CONGRESS JOURNAL

Volume 12 AUGUST, 1926 *No.* 8

IN THIS ISSUE

Western Mine Operators' Convention
A Standard Form of Metal Mine Accounting
Mining Methods in the Butte District
Mining Methods at Portland Mine
Statistics for Accident Prevention
Discipline and Underground Safety
Safety and Economy in Handling Explosives
Mine Fires and Methods of Handling Them
Roof Control and Mining Methods

News of the Mining Field
Practical Operating Men's Department

Contributors:

T. O. McGrath, W. W. Adams, H. J. Rahilly, J. W. Ady, Jr., W. Z. Price, J. E. Tiffany, George B. Pryde.

JOHN W. SHEERES

The Low-Vein Shortwall

Alone in its Class

A Real He-Cutter for Low Coal

Not an Adaptation of any other type, but a completely independent design to meet low coal requirements.

But it Includes the important features of operative facility and productive capacity which mean so much in Goodman machines for higher coal.

It Assures to the low coal Operator:

The same sturdy construction.

The same operative methods.

The same cutting speeds.

The same cutting depths.

The same linear feet of cutting.

"Book 240" is devoted to this machine alone.

Want it?

(18)

GOODMAN MANUFACTURING COMPANY

PITTSBURGH
CHARLESTON, W.VA.
ST. LOUIS DENVER

4746 to 4854 *South Halsted Street*
CHICAGO, ILL.

CINCINNATI
HUNTINGTON, W.VA.
BIRMINGHAM

To Prevent Mis-Fires and Weak Blasts

Up to a certain point the detonator is to a blast what the spark is to a motor. If the spark fails or is weak, the finest motor is useless or inefficient. When a detonator misses or is weak there is a missed shot or an ineffective one.

But there is this very great difference. A faulty ignition system can usually be repaired, and all is as before; the faulty detonator is seldom detected until the damage is done. This damage runs all the way from the loss in strength of the explosives on a small shot incompletely detonated, to similar losses involving hundreds of thousands of pounds. Missed holes take a heavy toll of time and labor from the blaster; they also increase the hazard of his work.

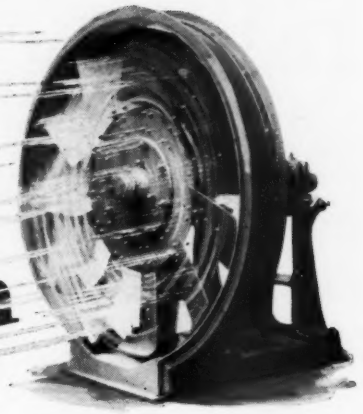
The performance of any explosive depends upon the performance of the detonator used. The elaborate and costly tests applied to Hercules Blasting Caps and Electric Blasting Caps are justified because of the part they play in the satisfactory performance of Hercules Explosives. Any user of explosives can get this protection against mis-fires or incomplete detonation by purchasing Hercules Blasting Caps and Electric Blasting Caps.

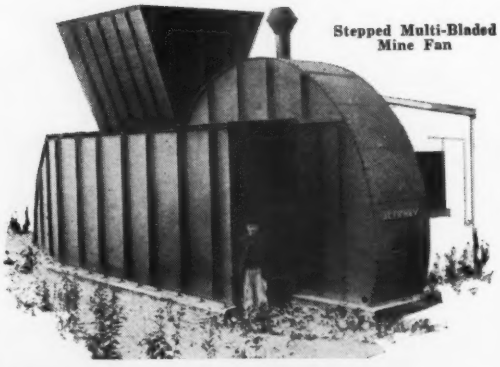
HERCULES POWDER COMPANY
(INCORPORATED)

Dynamite—Permissible Explosives—Blasting Powder—Blasting Supplies

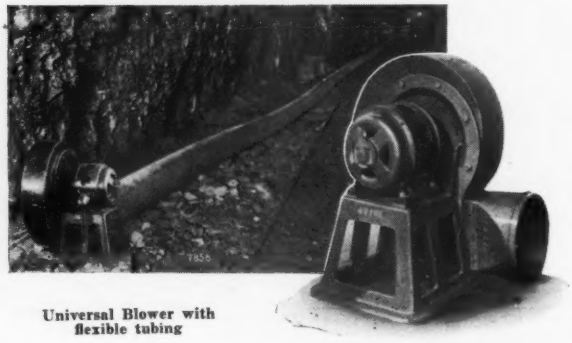
934 King Street Wilmington, Delaware

A Complete Service for Mine Ventilation





Stepped Multi-Bladed Mine Fan



Universal Blower with flexible tubing

From the main fan installed on the surface to the small booster fans for auxiliary ventilation, Jeffrey fan service for mines is complete.

Stepped Multi-Bladed Mine Fan—The stepped series of blades and ample sizes permit handling air at low velocities, cutting power bills 10% to 30%. Complete steel housing saves time, trouble, and expense to install. Sizes from 2 ft. to 18 ft. diameters with capacities of 10,000 C.F.M. to 600,000 C.F.M. Catalog No. 280-H.

Straitflo Fan—Used for ventilating small mines, developing larger ones, also for boosting purposes. Especially economical and convenient for Drift, Shaft and Slope Mines. Blades are designed to prevent the back-flow of air common to ordinary disc fans. Equipped with heavy self-aligning Roller Bearings. Carried in stock. Bulletin No. 348-H.

Universal Blowers—For use with flexible tubing in ventilating dead ends, entry driving, etc. Ball Bearing Motor (A.C. or D.C.) and completely welded steel housing are bolted to the same heavy cast iron base, making a self-contained equipment. Wheel is mounted directly on motor shaft—eliminates coupling and makes a compact unit. Sizes from 8 in. to 28 in. diameters with capacities of 500 C.F.M. to 10,000 C.F.M. One man can load and unload sizes up to 16 inches. Larger sizes can be handled by two men. Carried in stock. Bulletin No. 408-E.

Safeload or Backward Curved Fans for direct connection to motors.

The Jeffrey Manufacturing Company

958-99 North Fourth St., Columbus, Ohio

New York, Philadelphia, Pittsburgh, Scranton, Pa., Charleston, W. Va., Chicago, Denver, Salt Lake City, Birmingham, Montreal, Canada

Sales and Service Stations

Pittsburgh .....600 Second Ave.
Salt Lake City.....153 W. Second South St.
Terre Haute, Ind.....319 Cherry St.
Birmingham.....26 South 20th St.

JEFFREY
COAL MINE EQUIPMENT

Jeffrey-Standard Coal Mine Equipment

Coal Cutters
Combination Cutter and Loader
Drills
Conveyor-Loader
Sectional Conveyor
Pit Car Loaders
Locomotives
Mine Fans
Tipple Equipment
Crushers

THE MINING CONGRESS JOURNAL

AUGUST, 1926 CONTENTS $3.00 Per Year 30c Per Copy

EDITORIALS

Western Freight Rates 561
At the Close of the Session 561
The Oil Situation 562
Why Discriminate? 562
A Defensive Action 563
Promoting Foreign Trade 564
The Tariff An Issue 564
Helping the Miner Help the Manufacturer 565
British Coal Labor 565

FEATURE ARTICLES

Western Mine Operators' Convention 566
A Standard Form of Metal Mine Accounting—By T. O. McGrath 568
Industrial Accident Prevention Conference 572
Statistics for Accident Prevention in American Mines—By W. W. Adams 574
Roof Control and Mining Methods 576
Mining Methods in the Butte District—By H. J. Rahilly. 585
Mining Methods at Portland Mine—By J. W. Ady, Jr.. 589
The Relation of Discipline to Underground Safety—By W. Z. Price 591
Safety and Economy in Handling Explosives—B. J. E. Tiffany 593
Mine Fires and Methods of Handling—By George B. Pryde 598
Legislative Review 612

DEPARTMENTS

PRACTICAL OPERATING MEN'S DEPARTMENT, METALS 585
PRACTICAL OPERATING MEN'S DEPARTMENT, COAL 591
NEWS OF THE MINING FIELD 606
THE NATION'S VIEWPOINT 614
WITH THE MANUFACTURERS 616

NEWS

History of Explosives Industry in America 567
Public Land Classification 571
Manganese Production Increases in 1925 600
Silver, Copper, Lead and Zinc in the Central States in 1925 601
Statistics of the Copper Industry in the United States in 1924 and 1925 602
Asphalt Sales Increase in 1925 603
Current Oil Shale Bibliography 603
Increased Production of Metals From Secondary Sources in 1925 604
Alabama First Aid Meet 604
Mine Rescue and First Aid Contest 605

PRACTICAL OPERATING MEN'S DEPARTMENT

METALS

Mining Methods in the Butte District

Mining Methods at Portland Mine

COAL

The Relation of Discipline to Underground Safety

Safety and Economy in Handling Explosives

Mine Fires and Methods of Handling

Published Every Month by the American Mining Congress, Washington, D. C.

JAMES F. CALLBREATH
Editor-in-Chief

E. R. COOMBES
Editor

MCKINLEY W. KRIEGH
Assistant Editor

GUY N. BJORGE
Associate Editor

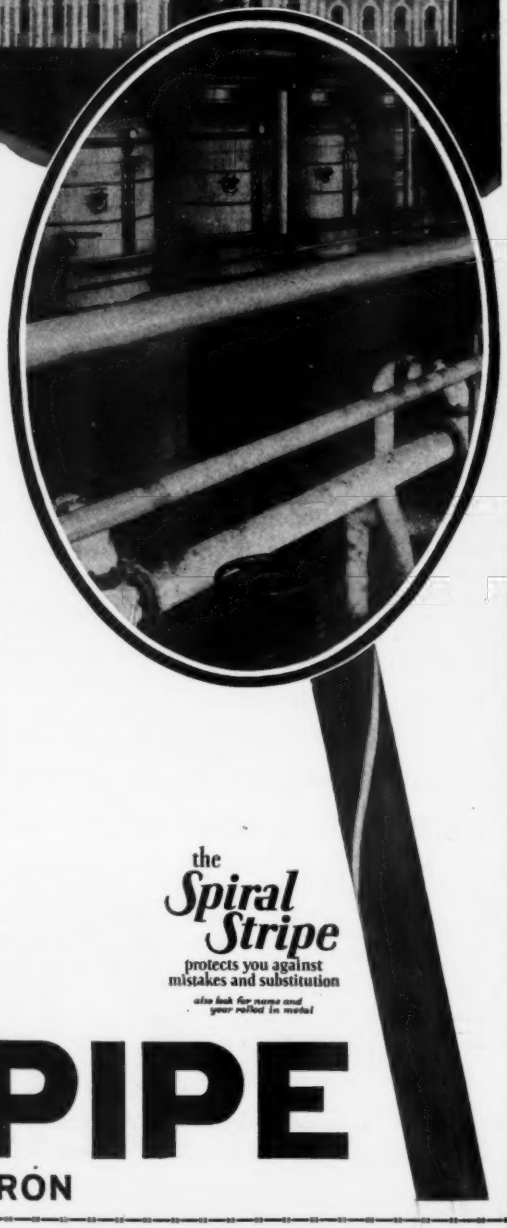
NEWELL G. ALFORD
Associate Editor

ERNEST H. PULLMAN
Legislative Editor

F. E. PRIOR
Art Editor

J. R. HURLBURT
L. R. HUDSON
Field Representatives

Entered as Second Class Mail Matter January 30, 1915, at the Post Office at Washington, D. C.



Where heat, moisture and acids savagely attack pipe

ABOVE is shown a photograph of Central Conchita, one of Cuba Can Sugar Corporation's many factories in which Byers Pipe is used extensively in lines subject to corrosion. Here, as in every other industry, genuine wrought iron pipe has abundantly proven its superior rust resistance, when put to the supreme test of time and service.

In lines conveying cold and hot water, condensate of steam, gases, juice or process liquids of many kinds, Byers Pipe, at a moderate first cost, gives the desired long life and freedom from costly failures with their attendant interruption of operations.

In such service, the life of Byers Pipe is two or three times greater than pipe not made of the same enduring material—genuine old-fashioned wrought iron. Byers Pipe is produced today by exactly the same processes as the old wrought iron which in many forms has survived for many generations after constant exposure to corrosive influences.

Ask for Literature

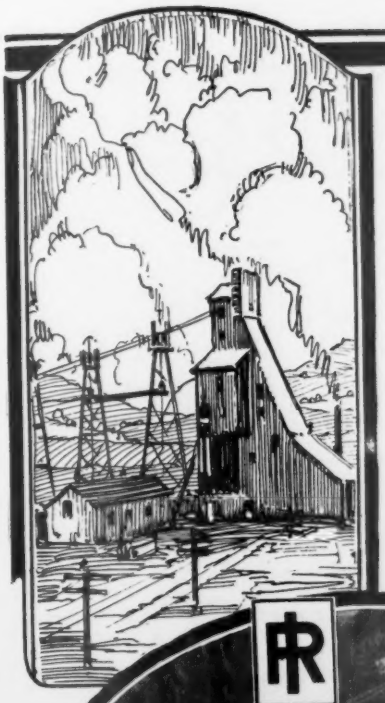
A. M. BYERS COMPANY
Est. 1864 Pittsburgh, Pa.

New York Chicago Cincinnati Jacksonville Tulsa Philadelphia Los Angeles Cleveland Birmingham Rochester Houston Boston St. Louis

the *Spiral Stripe*
protects you against mistakes and substitution
also look for name and year rolled in metal

BYERS PIPE

GENUINE WROUGHT IRON



A Glimpse Underground

A GLIMPSE underground in most of our mines would show that "Leyner-Ingersoll" Drifters do the bulk of the drilling. They are used on nearly every large rock drilling project, and exclusively on many.

The reason for their popularity can be found on the record sheets in the mine office. These sheets show, first, greatest drilling speed; second, *exceptional durability*; third, low maintenance cost.

The miners prefer "Leyner-Ingersoll" Drifters because they are so easy to operate.

Request Bulletin 4062.

INGERSOLL-RAND COMPANY-11 BROADWAY, NEW YORK CITY.

Offices in principal cities the world over

FOR CANADA REFER-CANADIAN INGERSOLL-RAND CO. LIMITED, 260 ST. JAMES STREET, MONTREAL, QUEBEC.

Ingersoll-Rand

Roebling

Blue Center Steel Wire Rope

Blue Center Steel Wire Rope is made to stand the strain of the heaviest hoisting and hauling conceivable. You can depend upon Roebling Rope for your shafts when you are lowering machine parts; for your hoists when you are hauling or lowering long strings of loaded cars down steep slopes; and for your outside heavy duty hoisting.

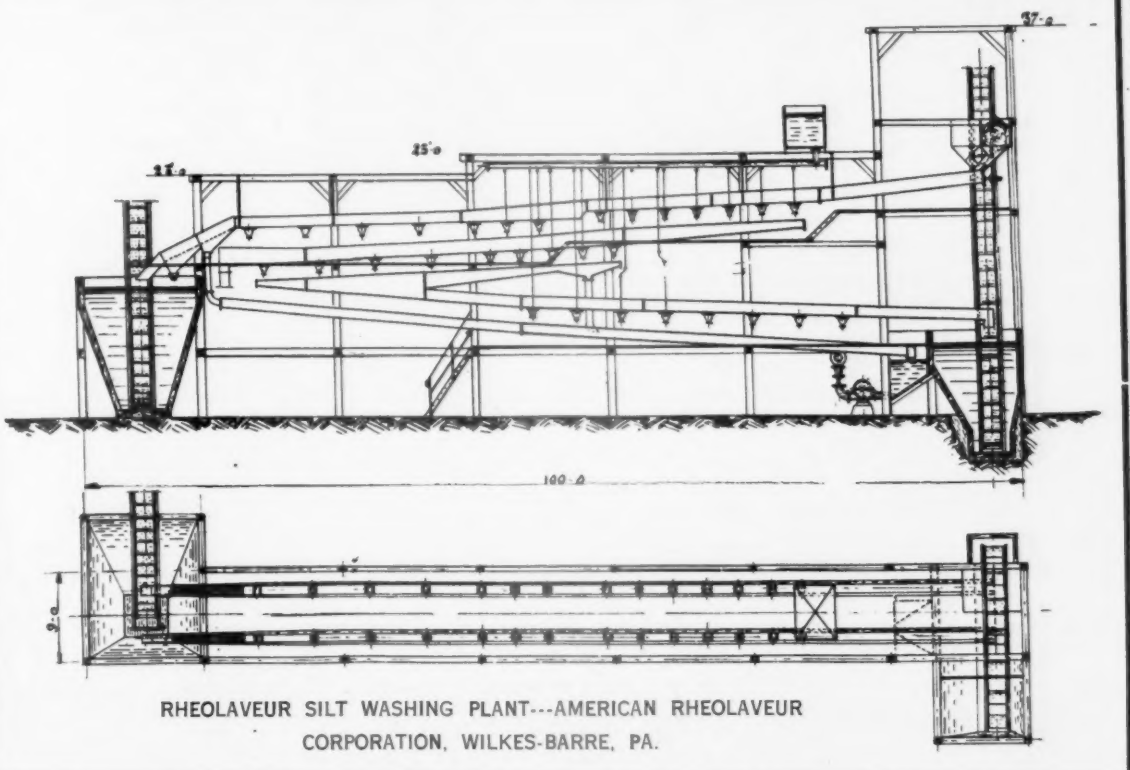
There's a Roebling Rope for every purpose

John A. Roebling's Sons Company

Trenton, New Jersey

There is **A Market** for **Low Ash Silt**

RHEOLAVEUR WASHES SILT SUCCESSFULLY AND ECONOMICALLY



RHEOLAVEUR SILT WASHING PLANT---AMERICAN RHEOLAVEUR CORPORATION, WILKES-BARRE, PA.

The washing of fine coal or silt has heretofore been difficult and expensive. Rheolaveur solves this problem.

A Rheolaveur Silt Plant recently put into operation in parallel with one of the most efficient silt plants of other types, has shown the following advantages:

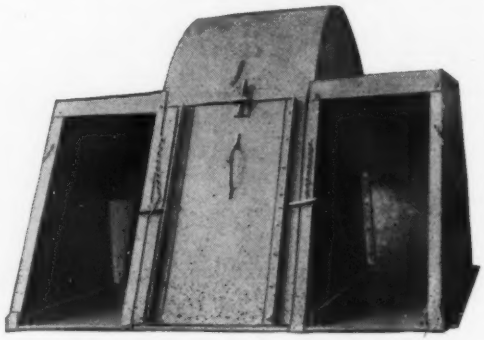
(I) Two-thirds Saving in Plant Cost;
(II) Fifty percent Saving in Operating Costs;
(III) Fifty percent Greater Capacity;
(IV) High Recovery with the Same Low Ash Washed Coal;
(V) Greater Ease in Control of Quality of Washed Coal.

AMERICAN RHEOLAVEUR CORPORATION

120 Broadway
New York City, N. Y.

911 Coal Exchange Building,
Wilkes-Barre, Penna.

A New Fan Idea in Design



Shifting the doors of the Lodwick Reversible Mine Fan reverses the air current; and this can be done in less than a minute. This fan is simple in construction and operation. It is designed to eliminate eddy currents and back lash. The propeller is supported on self-aligning ball bearings that practically eliminate friction and require infrequent lubrication. Send for catalog with suggestions helpful to the proper selection of mine fans.

Our line of mine equipment includes fans, longwall conveyors, dumping cages, weigh pans, coal chutes, mine cars, shaker screens and dirt dump equipment. Consult with our engineers before making any new installations.

We invite you to visit our experimental mine at Centerville, Iowa

THE CENTERVILLE FOUNDRY & MANUFACTURING CO.

CENTERVILLE, IOWA

Distinguishing Features

These distinctive features assure long life, safety, power and easy operation to the Vulcan Storage Battery Locomotive.

Equalizing Levers

By means of equalizing levers, links and bell cranks the inner ends of the springs are connected. Thus the same equalization of pressure on the journals, as secured for the Vulcan Trolley and Steam Locomotives, has been made possible for the Vulcan Storage Battery Locomotive.

Worm-Gear Drive

By means of a segmented shaft, flexible couplings and worm gearing, motion is transmitted from the single motor to the driving axles. Thus is utilized a type of drive the utility of which has been proven in motor trucks, tractors, etc.

Self-Locking Brake

A quick-acting, self-locking brake, similar to that of the Ford automobile, makes sudden stops a simple operation for the driver. Throwing a lever, which actuates a cam, through a half circle, applies or releases the brake.

Cast-Steel Bar Frame

Maximum strength, minimum weight and ample ventilation are secured by the cast-steel bar frames on each side of the body.

Vulcan Products

Hoists,
Electric and Steam
Locomotives,
Steam, Gasoline, Electric
Rotary Kilns, Dryers, Coolers and Roasters
Fairchild Double-Discharge Ball Mill
Mine Ventilating Fans
Cages and Skips
Sheave Wheels
Corliss Engines
Coal Crushers
Gray Iron Castings
Open Hearth Steel Castings
Gears, Moulded and Cut Teeth
Special Machinery

You can stop it in a jiffy

The brake on the Vulcan Storage Battery Locomotive is not unlike that on a Ford automobile. And you know how quickly and easily you can stop a "flivver."

Mighty useful, a quick-acting brake, underground when there are men, mules or a wreck just around the turn. The headlight spots the danger only thirty feet ahead; but the driver of the Vulcan throws the lever, and all's safe!

It will pay you to learn all the features of the Vulcan Electric Locomotives. They're listed in the panel on this page and described fully in the latest Vulcan Bulletins. Send for your copy.

VULCAN IRON WORKS

Established 1849

WILKES-BARRE, PA.

New York Office:
50 Church St.

Chicago Office:
McCormick Bldg.

VULCAN IRON WORKS OF Wilkes-Barre, Pa. U.S.A.
STEAM
GASOLINE
ELECTRIC
LOCOMOTIVES

The

PROCEEDINGS

of

Discussions of Practical Operating Problems

at the National Exposition of Coal Mine Equipment, held at Cincinnati, Ohio, May 24 to 28, 1926, are now available.

These have been reprinted from the JUNE, JULY and AUGUST issues of the MINING CONGRESS JOURNAL and bound together.

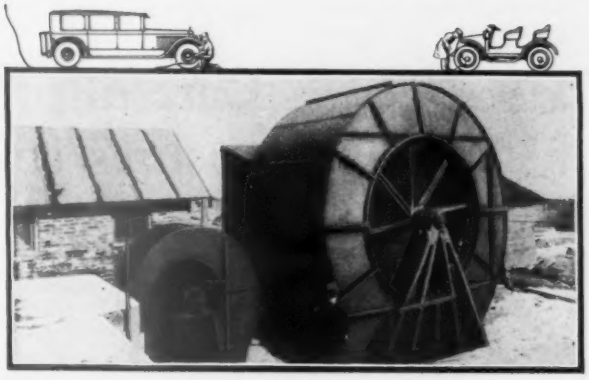
They may be obtained for two dollars apiece. Please address—

The AMERICAN MINING CONGRESS
841 MUNSEY BUILDING • • WASHINGTON, D. C.

Bringing Air Up to Date

When installed 25 years ago, the Robinson Steam Fan illustrated to the right was the last word in ventilating efficiency. Today the newer and smaller Robinson Motor-Driven Turbine Fan delivers more air — and saves money in the doing!

May we tell you how modern Robinson Fans can cut your ventilating costs?



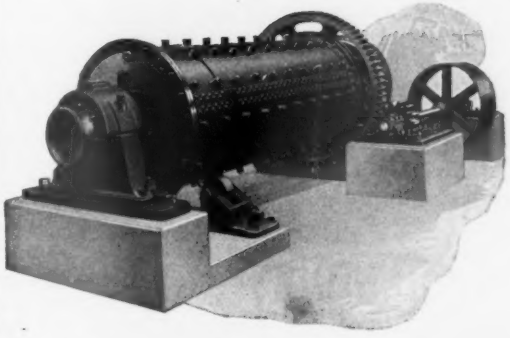
New Robinson 5-ft. Motor-Driven Turbine Fan alongside the Robinson 12-ft. Steam Fan it replaced at the Winburne Mine of the Pennsylvania Coal & Coke Co., Cresson, Pa.

ROBINSON
House Bldg. Ventilating Co. Pittsburgh

Antiquated equipment costs money—more money than modern and better equipment. Andrew Carnegie realized this and it became one of his cardinal principles of success

TELL US YOUR VENTILATION NEEDS. OR BETTER YET, LET US SEND AN ENGINEER TO SURVEY YOUR MINE. NO OBLIGATION

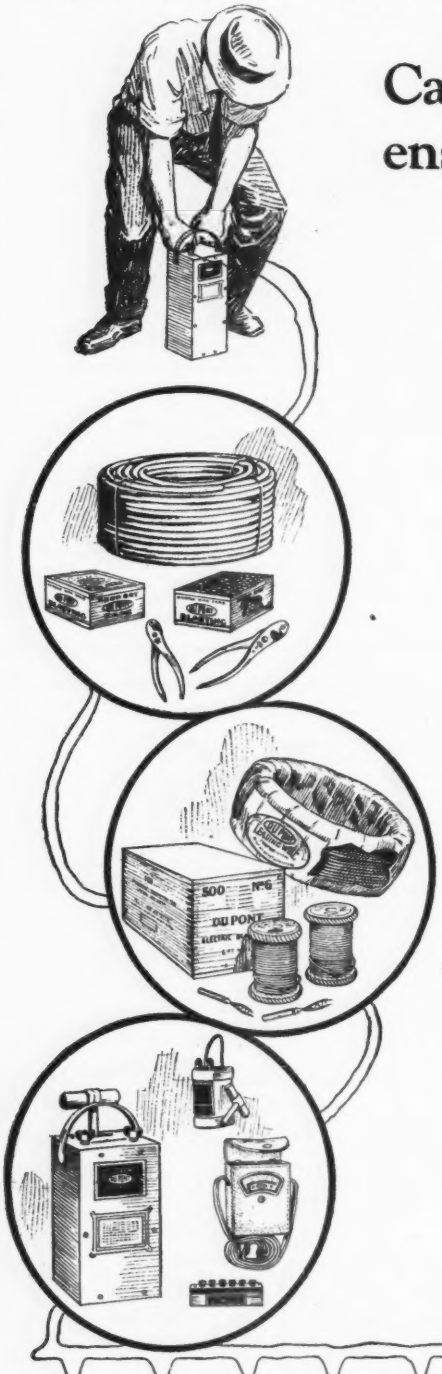
ROD MILLS



Allis-Chalmers Rod Mills embody the same rugged construction, high grade material and workmanship, characterized in the Ball Granulator.

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

MAKERS OF POWDERS SINCE 1802



Careful preparation ensures complete detonation

"FOR want of a nail the shoe was lost; for want of a shoe the horse was lost; and for want of a horse the rider was lost."

Everyone who has anything to do with blasting work thoroughly appreciates this way of Benjamin Franklin's saying, "Perfection is the sum of many details." Production of materials, efficient work, progress and prevention of accidents are dependent upon the reliability of such an agent as a blasting cap.

Yet the actual cost of reliable blasting accessories is relatively so trifling that it is obviously wasteful to compromise with anything less than the accessories made by du Pont, thoroughly dependable for three very logical reasons:

FIRST: **Du Pont Blasting Accessories are the products of the oldest explosives manufacturer in the country —125 years of explosives experience.**

SECOND: **Right because made in the most complete explosives plants in the world; rigidly inspected at every step of manufacture, and their performance practically observed in the field.**

THIRD: **That no other accessories perform more efficiently is demonstrated by the increasing demand for du Pont Blasting Accessories.**

Don't temporize! The most economical way is the sure way — insist on the use of du Pont Blasting Accessories.

Send for catalog giving practical data relating to selection and use of du Pont Blasting Accessories.

E. I. DU PONT DE NEMOURS & CO., Inc.
Explosives Department
WILMINGTON, DELAWARE

DU PONT

Blasting Accessories

125 YEARS OF LEADERSHIP IN THE SERVICE OF INDUSTRY

The MINING CONGRESS JOURNAL

PUBLISHED EACH MONTH BY THE AMERICAN MINING CONGRESS MUNSEY BLDG., WASHINGTON, D. C.
Subscription Rate: Per Year, $3.00 Single Copies: $0.30

VOLUME 12 AUGUST, 1926 NUMBER 8

WESTERN FREIGHT RATES

THE fact that the Interstate Commerce Commission has reached a decision upon the petitions of the western railroads for a percentage increase in freight rates, denying these petitions and holding that no financial emergency exists such as would warrant changes in rates at this time, should have a beneficial effect upon all classes of business in the western district.

This decision of the commission undoubtedly was anticipated by the carriers. As a matter of fact, it is probably the end which they sought to accomplish by filing the petitions for a percentage increase. Their petitions were filed following the institution by the commission of the general rate structure investigation authorized and directed to be made by the so-called Hoch-Smith resolution.

That resolution was designed, according to its sponsors in Congress, primarily to bring about rate changes that would relieve somewhat the post-war depression, and at the same time improve the economic conditions, of the agricultural and live-stock industries. Since the bulk of the traffic from these industries originates in the western district, it was obvious that the carriers must assume that the commission would undertake the task assigned to it under the Hoch-Smith resolution by giving first consideration to rates in the western district. The carriers' petitions for a horizontal increase in rates served as a protective measure as the result proves.

The commission finds that conditions have been improving in the agricultural and live-stock industries. Their decision, however, carries a conclusion that should give considerable satisfaction to the representatives of those industries. While they say that there are many inequalities in the rate structure existing in portions of the western district which should be corrected, and also indicate that the carriers may properly initiate some changes in rates with the object of improving their earnings, they definitely concluded that in proposing any changes in the existing rate structure either for the purpose of improving earnings or for the purpose of rectifying inequalities, the carriers should propose no advances in the rates on products of agriculture, including live stock, except where particular rates on such products may need adjustment to remove inconsistencies, or where it can be shown that the product in question is not affected by depression.

The outstanding fact about the commission's examination into, and numerous hearings upon the rate structure in the western district is that notwithstanding the voluminous record made, which includes an enormous mass of statistical data and testimony, this record is considered unsatisfactory and incomplete and not conclusive as to any of the vital points involved. The commission uses all through its opinion such expressions as the following: "We can properly prescribe them (changes in rates) only upon clear evidence of urgent necessity." "The present record would not enable us to do so (prescribe individual rate changes) to any considerable extent." "The record as it stands today (does not warrant us) in making any general downward revision of rates on products of agriculture, or of other industries subject to depression." "It is our purpose to attempt to obtain further information to enable us to determine what, if any, readjustment should be made as between commodities or in furtherance of the rectification of the rate structure as between particular points and districts."

This tends to prove the contention that we have made ever since the passage of the Hoch-Smith resolution that the task imposed upon the commission by that resolution, without provision or appropriation of any kind for this work, makes it impossible of performance. The Hoch-Smith resolution has been a statute for nearly a year and a half with no tangible results.

The length of time that it has taken for the consideration of rates in the western district, and the fact that the record made is not adequate for the commission to act upon, demonstrates the necessity for Congress either to make proper provision for this undertaking, or better still, to repeal the Hoch-Smith resolution and permit the shippers and carriers to work out necessary readjustments of rates among themselves.

AT THE CLOSE OF THE SESSION

CONGRESS has adjourned. That portion of the people who have succeeded in securing the things they felt necessary from Congress are rejoicing; those who have measures still pending are not pleased. The country needs a rest from legislation, investigations, and political turmoil. And the representatives themselves have had a strenuous series of sessions during the last five or six years.

The closing session of the Sixty-ninth Congress was, perhaps, the most strenuous of all. Some matters have been disposed of with almost miraculous accord—for example, the tax bill—but in other matters Congress was hopelessly deadlocked. The session closes leaving Muscle Shoals on the shelf; farm relief in the air; coal legislation on the table; other matters in pigeonholes; and numerous pending measures that have involved much study remain uncompleted.

The mining industry is well satisfied with the work of the 69th Congress. The industry, along with others, has been worried by unnecessary investigations; but Congress, in the end, has lived up to its reputation as a fair-dealing body, and results have not been harmful even though little of benefit can be seen. It has been an up-hill drive to convince members of Congress of the equity and justice of the mining industry's contentions, particularly with reference to taxation; but in the end the facts were recognized, and the industry is on a broader road to prosperity.

THE OIL SITUATION

THE recent report of the American Petroleum Institute furnishes convincing proof that the oil industry, without Government aid, subsidy or regulation, is pursuing a policy that will insure for the future an adequate supply of oil for the national defense, and for essential uses in this country. This report which was submitted to the Federal Oil Conservation Board, meets effectively the propaganda that has been broadcast during recent years for the purpose of frightening the people into making a demand upon Congress for a law and a permanent governmental agency for the control and regulation of oil development and production.

The report points out that the current supply and demand cannot stay in balance because the amount of both supply and demand are constantly changing; but that insofar as future reserves are concerned there is no present indication of exhaustion or of failure to bring in new fields as long as adequate incentives to exploration continue to exist.

The conclusions reached by the Institute are obvious to all who are familiar with the history of the oil industry and its present policies and program for maintaining an output that will continue to increase as the demand for petroleum products increases.

We pointed out in these columns more than a year ago that in order to maintain an adequate production and supply of oil, conditions must be such that the wildcatter and speculator will continue to search for new fields; that neither the wild-catter nor established producer shall become discouraged by the hazard of dry holes; that those engaged in experimentation for and improvement of methods and processes of producing and refining shall be assured of appropriate reward of success; and that capital shall continue to flow into the oil industry for its development and expansion.

The report calls attention to the fact that the Nation has enormous potential reserves of oil in the vast deposits of oil shales, coal and lignite, from all of which liquid fuel and lubricants may be extracted if and when the cost of recovery is justified by the price of these products. Scientific experimentation in this direction has been going forward for many years, with most promising results. It is not at all too optimistic to assume that the progress that has been made along these lines is sufficient to demonstrate the practicability of drawing upon these sources and reserves the moment a serious shortage of crude oil occurs, if that ever happens.

The public has only to understand what has been and is now taking place in the oil industry to realize that the alleged danger of exhaustion of our oil supplies is not imminent, but on the contrary is remote. Enormous expenditures are being made constantly for the improvement and enlargement of existing refineries. New refineries are being built and continued improvements are being made in existing oil fields to provide adequate transportation for the output which is constantly increasing. It can be assumed that these expenditures would not be made if the great plants and facilities for transportation and distribution were threatened with any danger of being shut down or scrapped. Investments such as are being made today in the oil industry would not be made in the face of any such possibilities.

If the oil industry is permitted to remain free from governmental restriction and regulation, and the initiative, judgment and foresight of the investors, executives, and managements who direct its destiny are permitted to function freely, together with the unrestricted operation of the law of supply and demand, the Nation will be assured of a continuous supply of oil to meet its requirements at a price that will continue to be within the reach of every consumer.

WHY DISCRIMINATE?

DURING the last session of Congress the "help the farmer" slogan gained impetus. All of the measures to relieve the agricultural industry failed of passage, largely because in the final analysis, practically all the remedies suggested would have further complicated the Sherman Anti-Trust Law. The farmers have been specifically exempted from the provisions of this act and are at complete liberty to combine to restrict production in any line.

The Sherman Anti-trust Law applies with full force to the operation of mines, and not only are the mine operators prohibited from restricting production, but are not permitted to gather and circulate information as to past transactions. The Webb-Pomerene Act has been of some assistance to the industry, and operators have taken advantage of its provisions in such organizations as the Copper Export Association, etc.

The Department of Justice a few years ago, when asked for an opinion concerning the legality of certain activities of associations, said:

"Those who organize and conduct these associations appear to entertain the idea that if the information imparted relates only to past and closed transactions there can be no violation of the anti-trust act. In my judgment such an idea is wholly fallacious. One's future conduct is to be judged by what he has done and is then doing, and not so much by what he says he will do. It is one's actual conduct that is taken as an example for imitation. It has developed in the trial of cases involving associations that the members first agreed upon prices; but such a plan did not work because the members could not be relied upon to keep the agreement; and the system of exchanging statistics was adopted because it was found to be the only effective way to procure cooperation as to prices and production; * * *."

It is difficult to perceive the justice of permitting those who control the supply of food, which is the first necessity of existence, to combine in curtailing production and restricting supply, while those who produce minerals, which are a secondary necessity, are held to a strict construction of the terms of the Sherman Anti-trust Law.

We agree with our Secretary of Commerce, Mr. Hoover, that competition based on fair and equal information of existing conditions would more likely result in lower prices to the consumer, than competition based on uncertainly, in which each dealer must add something to his price to cover unforseseen eventuality.

Stabilization of industry is one of the great things to be desired, particularly in the mining industry. If left alone the mining industry will eventually work out the solution in spite of the handicaps, but the happy day of stabilized industry would arrive more quickly, if the industry could be unshackled.

A DEFENSIVE ACTION

THE coal industry of Ohio has an equipment capable of producing, easily, 35,000,000 tons of coal a year; when active, it is responsible for a distribution in wages annually of at least $50,000,000. The various coal-producing districts of Ohio yield a variable quality, which makes a wide appeal to the household trade and has caused industry in the whole northern and eastern portions of the state to rely upon it. In addition, this coal has appealed to industry served by the lake carriers, whether in the Northwest or in Canada. Under present conditions the state has the capacity to produce, easily, from 6 to 10 percent of the Nation's coal requirements.

Beginning with the effective date of the Jacksonville wage scale for coal miners, namely, April, 1924, this coal field showed signs of decay. At the end of a year and a half under that wage scale, the president of the Miners' Union said that it was impossible to expect that the coal-producing district in the central-southern portion of the state would ever again be in a competitive position. He said it was doubtful whether portions of the eastern Ohio coal field would ever resume operations. This meant, of course, that to protect its interests elsewhere, the Miners' Union intended to maintain a wage scale which would leave these particular fields in no position to even hope for a competitive equality with surrounding coal-producing areas. Thus, Ohio was expected to continue idle under the dominance of the Miners' Union, while coal-producing areas immediately to the south and on the opposite bank of the Ohio River were at liberty to make other arrangements. In detail, the southern fields pay a wage scale which is only from 60 to 65 percent of the Ohio scale. The advantage of these southern fields in the matter of wage scale is offset to an extent by the fact that to reach the northern markets they must pay a higher freight rate to the minimum extent of 40 cents a ton. The freight rate differential does not equalize the two wage scales. Thus when the southern operators are offering a better quality of coal at a lower price, Ohio can not hope to compete. Therefore it seems that a very large section of the Ohio field is doomed to ultimate extinction, while the other half is confronted by a most precarious existence.

The Ohio operators were wholly unwilling to accept, without protest, any such an arbitrary decree as seemed to leave them no hope for the future, when the alternative was available, namely, to discontinue allegiance to and dealings with the Miners' Union. If it came to a question of throwing over the Miners' Union or of retiring from the business, the operators might be expected to choose the former. What seems to be the ultimate and inevitable decision has not been reached, even though the operators have taken a strong defensive action.

Within the last month, following a meeting at Columbus, Ohio, those operators organized and incorporated the Ohio Coal Operators' Association, arranged for its financing, and elected a full set of officers and directors. The primary purpose of this organization is to defend the industry and to put it in a position to compete. Beyond the declaration of that purpose, the association, so far, has not gone. It announces that the mines which are now in operation are going to be put in a competitive position with any and all other coal fields, and that mines which are now in idleness will be put in a position to resume operation. It has not said, so far, exactly how this is going to be accomplished—the method of procedure being a detail reserved for the future. Everyone recognizes, however, that the wage scale must be readjusted. Some of the operators still believe that it will be possible to deal with the present union. Others, who are not so optimistic, believe it will be possible to deal with a union—perhaps some such organization as is now being effected in western Pennsylvania. A third group, however, takes the position that their competition is non-union and that Ohio can be in a competitive position only by itself becoming a non-union district.

The essence of the question is contained in this: The Ohio operators recognize that their business is competitive. They have demonstrated, through a year and a half, that they are no longer able to compete. They say that the reason is that their miners are not disposed to be competitive; that they have affiliated themselves with an organization which ignores the competitive strength of the non-union field. The operators conclude, therefore, that a competitive business can not succeed unless its labor is also competitive. This puts it squarely up to the Miners' Union to compete with the non-union field—union labor to compete with non-union labor—or retire from the field, leaving the operators in position to survive by employing labor which will compete.

When taking such a strong position, the Ohio operators announced another policy which is far-reaching. It is known, of course, that 30 years ago, almost to the day, the Ohio operators joined with their fellows in western Pennsylvania, Indiana, and Illinois to organize what has since been known as the central competitive field. This grouping of interests was effected for the purpose of negotiating wage contracts with the United Mine Workers of America. It is known that this was the nest in which was hatched the whole strength of the Miners' Union, because it was the exclusive contract with these operators and the check-off which they granted that gave the union the power and the money to go into the so-called outlying districts and extend its zone of influence. Also, it was the solidarity of this central competitive field in its allegiance to the union which gave the latter its strength. Fully a year and a half ago, western Pennsylvania announced its withdrawal from the central competitive field, leaving to the latter merely Ohio, Indiana, and Illinois. Now, following the organization of their new association, the Ohio operators have announced that they, in future, are going to act independently of any other state. This is merely another way of saying that they propose forthwith, and as a matter of policy, to retire from the central competitive field. It follows that with Ohio and western Pennsylvania out of it the central competitive field, as once known, no longer exists. And that, in turn, means that the backbone of the Miners' Union has been broken. Thus it was drastic action, which the Ohio operators took, but they did so only because they had no other way of maintaining their competitive position in the bituminous industry in which, as is known, the competitive factor is unusually strong.

This action by the Ohio operators is, necessarily, significant of many things. The one which makes the strongest suggestion is that the bituminous industry has abandoned itself to the excesses of competitive action. The first act of this new competition is to break down the one cooperative unit which has ever exercised any restraint whatever upon the action of any portion of the coal field. That restraint was always exercised in behalf of the miners. The miners, however, made arbitrary use of the protection they thus were given and have refused to compete at all. The net result is the operators are forced to strip the miners of that protection, because they refuse to protect the industry which employs them.

PROMOTING FOREIGN TRADE

THE bill to create a bureau of foreign markets in the Department of Commerce failed of passage because American business interests failed to get behind it with their full strength. Is such a bureau, with a corps of foreign trade representatives stationed abroad, what American business wants and is it what they need to promote more efficiently the work of extending our foreign trade and commerce?

The purpose of the bill was to enable the present efforts of the Department of Commerce to be better organized and conducted on a more permanent basis than is now possible. The department for many years has kept trained geologists, engineers and trade representatives in the various countries where embassies are maintained, whose duty it is to report regularly to the department on trade and economic conditions generally, and on specific matters of interest to American business concerns. Would this bill have enabled American business to be served more efficiently through the enlargement of the department's organization and functions in this important field?

This leads to consideration of the present organization and functions of the consular service of the State Department. The consular agents of the United States have been very active in aiding American business abroad. This has been one of their principal functions. For many years they have furnished elaborate and valuable reports on commercial and economic conditions in the various countries to which they were assigned. Their success in procuring vital information long has been traditional, and their efficiency has been recognized universally.

The question that arises, therefore, is whether this vastly important work can be improved by enlarging the jurisdiction and organization of the Department of Commerce or whether American foreign trade and commerce can be better served by strengthening and enlarging the functions and organization of the consular service so that every phase of the work may be fully coordinated under the authority of a single governmental agency.

The mining industry is affected by foreign trade and economic conditions to a greater degree perhaps than any other basic industry in this country. Many of the larger mining companies employ trained economic geologists in various countries whose duties mainly are to investigate and report upon the mineral resources, and potential, as well as actual, mineral production, of those countries. If the Government would make it the function of some agency, through trained representatives stationed abroad, to give the mining industry of this country accurate information and a reliable forecast upon foreign competition, not only for one year, but for future years, it is believed most valuable results could be accomplished.

We are holding no brief for either the Department of State or the Department of Commerce. Any plan that would cause a duplication of effort or a conflict between the functions of these two departments which might cause one to slacken its efforts or the other to lose the cooperation so necessary to make the work of both articulate and effective, would be unfortunate. Perhaps the best means to the desired end is not only the continuation of the cooperative arrangement that now exists between the two departments, but, in the absence of any suggestion for a better plan the extension of that cooperative arrangement by providing for the appointment of trained economic geologists as consular attaches, such appointments and assignments to be made upon the recommendation of the Department of Commerce. It is believed that such a plan would avoid all possibility of duplication of effort and friction, and at the same time would enable these attaches to enjoy all of the advantages that the prestige and traditions of the consular service can give them.

The mining engineering profession can furnish any number of trained men who are fully equipped and amply fitted for the duties that would be involved. The Department of Commerce can procure the services of the best men available. The Consular Service can give these men the prestige needed to stablish necessary contacts abroad. Why can not this important work be dovetailed and coordinated in such a manner as to eliminate lost motion, friction, and duplication, and accomplish the greatest good for the American mining industry?

THE TARIFF AN ISSUE

NO subject has been the cause of more prolific discussion and acrimonious debate than the tariff; yet nothing is so little understood, and so generally misunderstood by the general public. The tariff has been the cornerstone of many presidential campaigns, and political campaigns have been won and lost upon this important issue, affecting as it does the very vitals of our industrial life. Countless tariff speeches have been made, and thousands of pages of the Congressional Record have been filled with debates upon this subject. The tariff question, unfortunately, is still in politics, although it ought not to be, for as long as it is discussed from a political standpoint it is more confusing to the public than otherwise.

There was nothing about which those who opposed the present tariff were so certain as that it would act almost as an embargo on imports. If these critics had investigated the results of previous tariffs and had not closed their reasoning powers to those results, they would not now be so discredited as prophets. There is no argument that is as fallacious as that which is now being used to arouse the antagonism of the farmers to the effect that the manufactured products are being protected on a basis far above the world price level while farm products are compelled to compete on the lower basis and that agriculture therefore does not enjoy economic equality with other industries.

The fact of the matter is that if home industries were not protected by an adequate tariff the farmers would not have the home markets they now have, especially for perishable products, and freight rates alone would prevent a wide distribution to points where their other products might find a market. The present tariff law has created and maintained home markets for the farmers, which radical changes downward would partially, if not completely in many instances, destroy.

Insofar as the mining industry is concerned, the effect of the tariff has been to stimulate production, and in at least one instance, has brought about a cheaper product than under a free market. Last year there was spent in the State of Idaho more than $3,000,000 in development of its mineral industry. Would this capital have been spent if the products of that state had not been protected by an adequate tariff from cheap foreign production? In Colorado, as in practically every western state, mineral production is on the upgrade and largely because of the tariff.

The present tariff law has its imperfections, and as conditions change, need may arise for revision. The present law permits necessary changes under the flex-

ible provision. The mining industry owes a debt of gratitude to a far-seeing Congress, that enacted the metals schedule of the Fordney-McCumber tariff law.

HELPING THE MINER HELP THE MANUFACTURER

THE manufacturers of mining machinery and equipment profit just to the extent that the mine operators, through profits to be derived from their operations, are able to purchase and install improvements and additions to plant and equipment as a necessary measure to reduce costs and increase efficiency in production. Depression in the coal industry has been so acute that the operators have been reluctant to invest anything in new equipment; but they are now beginning to realize that the only practical solution of the problem of high costs that exists today rests in the mechanization of their mines.

Scientific and practical research, experimentation and invention have developed new methods, devices and improvements that are revolutionizing coal mining operations. Their feasibility and utility, and the economies they effect, are being demonstrated. The possibilities for improvement of conditions in the coal mining industry by further mechanization of the mines, have been effectively shown through the annual expositions held under the auspices of the Manufacturers' Division of the American Mining Congress. These expositions have been successful, and the discussions of practical operating problems that accompanied them have been full of helpful material for the operators.

The manufacturers of mining equipment and supplies are an integral part of the mining industry. The movement, fostered by the American Mining Congress, to induce them to promote their common interests by means of organized effort, has proved successful. No manufacturer can longer doubt the wisdom of this program inaugurated a few years ago when the pinch of depression was just beginning to be felt in the coal industry. Nor can the wisdom of carrying it forward with greater vigor be doubted as it is certain to promote stability and efficiency, to lower costs and insure greater earnings, and thus increase the purchasing ability of the coal operator.

BRITISH COAL LABOR

THE strike of the British miners has continued three months, or the length of time which Mr. Lloyd-George says is usually required for such a dispute to wear itself out. He says that it has been found impossible for the British miners to carry on much beyond that length of time. The present strike has continued an unusual length of time, because all parties in interest have stood with unusual solidarity behind their particular points of view. Reduced as nearly as possible to an arithmetical statement, the situation seems to be about as follows:

With respect to a matter of 200,000,000 tons of production, or approximately the consumption of the British Islands, the British coal industry is not competitive with the coal business of other countries. But, to the extent that British production rises above the 200,000,000 ton minimum, Great Britain is competitive with the rest of the world, because that excess goes mostly into the export trade.

With respect to their own fuel, the British people have to pay for the 200,000,000 tons of coal whatever it may cost to produce it. That is, they can either pay to the operator a mine price which warrants its production or they can pay a part of the price to the operators and a part of it in the form of general taxes, and let the Government subsidize the industry out of the public treasury. In either case, the people of Great Britain pay the full cost of producing the 200,000,000 tons of coal which they use.

However, the purpose of the subsidy was to encourage the continuance of the overseas trade in coal, and, therefore, to keep the men fully employed. For several years that overseas trade has never been quite 4,000,000 tons a month. However, the subsidy, according to figures which have been developed by Parliament, has amounted to approximately $10,000,000 a month. That means that when the whole subsidy is applied to the export trade it has amounted to $2.50 or more a ton of export business. It is tremendously important to Great Britain to have its export trade in coal going, because that affords the main appeal which British commerce makes to the outside world. It is the mainstay of Great Britain's overseas commerce.

When it came to computing the cost, Great Britain could not see her way clear to continue any such a subsidy; the Government has stood firmly against it. At the same time, the British coal owners maintain that they can not pay the present labor cost of production unless they have that subsidy. The plain arithmetic, therefore, is that the coal industry, on the present cost of production and the present market price, is $10,000,000 a month or more short of paying its actual out-of-pocket cost.

In his recent testimony before the House committee, Secretary Hoover made the statement that the British wages are about 35 percent of those paid the coal miners of the United States. Instead of paying a minimum of $7.50 a day, or the wages demanded by the American union, the average of the British coal miners is in the neighborhood of $2.50 a day. It is rather too much to expect that the British miners extract $10,000,000 a month from any such earnings as they have on that rate of pay. That part of the arithmetic doesn't check out and seems to leave the British coal situation in rather a hopeless position.

However, the difficulties are not so large as might appear on the face. Those who have studied English industrial conditions understand that the British miner has been avoiding work. He hasn't been willing to produce. In addition, he has demanded other concessions in the way of the most elaborate outlays for social account. These two factors have combined to increase the labor cost of production to the point indicated. It has been contended from beginning of this controversy that if the miners were willing to waive their demands for easy working conditions and for the social extravagances, the labor cost of production could be cut sufficiently to meet the situation.

Recently the ecclesiastics of Great Britain studied the situation. Rather than preaching to the miners a sermon on diligence and hard work, they ignored the real point of the controversy and recommended that the Government continue the subsidy. This brought from the Government a flat refusal to meet that demand; from the coal owners a flat refusal to consider it; and from the miners an ardent approval of the demand of the ecclesiastics.

After three months, therefore, the situation is exactly where it started, with no prospect of any relief until, as Mr. Lloyd-George says, the miners are starved out. In the end, the miners must accept the terms of the coal owners and the Government, because they will have nothing else to do.

WESTERN MINE OPERATORS CONVENTION

Meeting Of Western Division Of The American Mining Congress To Be Held In Denver In Co-operation With Meetings Of Western Section, American Institute M. & M. Engrs., American Ass'n Of Petroleum Geologists And American Silver Producers Association

THROUGHOUT practically all of the western states during the past year there has been a most decided revival of mining activity. Research, development and general interest in mining has probably been more widespread than during any like period in the history of the industry. As a result of new and improved metallurgy, scientific development and an increasing demand for metals, oil and other mine products, the western mining states undoubtedly stand at the threshold of a new period of mining development and production. In consequence, new problems are confronting the operator, and united and concerted action of all those engaged or interested in the development of the mineral resources of the west is, and will continue to be, more imperative than ever before.

Confronted with a situation following the war which threatened disaster to the industry, mining men took up their problems with the same vision and courage which actuated the sturdy band of pioneers and prospectors, who, a generation before this, peopled the great west. With a determination that would not be denied, the same spirit of adventure, aided by modern science, is now developing the mineral resources of this great territory, and, adjusting operations to meet existing conditions, is removing the obstacles which for a time have barred the way to normal activity.

Through organization and cooperative effort, by research and active development, the adoption of improved metallurgy and operating equipment, by combatting discrimination and unfavorable legislation, by stimulation of markets through fostering a wider use of mineral products, and with the help of associated or allied industries, the mining industry is making an amazing recovery, and throughout all the mountain states there is an outstanding promise of a new era of mining activity.

The American Institute of Mining and Metallurgical Engineers, and the American Association of Petroleum Geologists have arranged to hold a joint meeting with the American Mining Congress during the week of September 20, and to this end these organizations urge their members, as well as others directly interested, to meet with them for a thorough consideration of the major problems that may be appropriate for each organization, or for combined action by all.

Under the joint auspices of the above organizations, the convention promises to be one of the most important meetings of mining men ever assembled in the west. Questions for consideration will be presented by speakers of national reputation and experience. It has been arranged that discussion of an economic or semi-political nature shall be under the auspices of the Western Division of the American Mining Congress, and that the American Institute of Mining and Metallurgical Engineers and the American Association of Petroleum Geologists will consider new technical progress in mining, metallurgy and the petroleum industry.

Mining and Public Lands

Among the topics to be considered by the American Mining Congress will be the policy of the National Government regarding the holding or disposition of public lands, particularly as affecting the mining industry.

Secretary of the Interior, Dr. Hubert Work, who has been invited to address the convention, says:

"I do not believe in piecemeal legislation covering mining on public lands, leasing of coal, potash and kindred material, together with oil and oil shale, which has injected itself into the administration of public lands in recent years, or grazing on the public domain, will meet the situation without embarrassing administration, but they should all be comprehensively considered at the same time and a comprehending policy defined, so that the different activities should not be thrown in conflict with each other by special legislation enacted in their interests. Your proposed conference will be a welcomed opportunity to present those tentative suggestions to those who have views born of experience on these important questions. I shall see to it that this Department is represented at the meeting—by myself, if possible."

The Federal Leasing Act

Another question for consideration and discussion by the Mining Congress will be the Leasing Act as affecting the public land states.

Has its operation proven generally beneficial to the western states?

Have the benefits to the states in which Federal lands are located compensated for the loss suffered on account of the withdrawal of coal, oil and shale lands from private ownership, which would otherwise be a taxable asset for these states?

Should the present tendency of Congress to extend the provisions of the Leasing Act, and to foster further withdrawals of public lands, be encouraged or resisted, and have the states a sound basis for resistance?

Is it a fair and equitable distribution of the funds derived from royalties under the Leasing Act that 37½ percent should be returned to the states from which they were derived; 10 percent to be retained at Washington for administration expenses, and 52½ percent devoted to reclamation projects for agricultural purposes?

It is proposed that this question, like all others that may come before the meetings, shall be taken up in a broad-minded way for the purpose of developing all possible information on which to base conclusions as to what is best for all concerned—the nation, the state, and the mining industry.

Secretary Work, of the Interior Department, will speak for the Government. Congressman Charles E. Winter, of Wyoming, will speak upon the Leasing Act as it affects the public land states; and ex-Land Commissioner Clay Tallman will treat the subject from the viewpoint of the operator.

Secretary of Commerce Herbert C. Hoover

Secretary Hover is expected to address the convention upon current issues affecting the mining industry as presented to the United States Department of Commerce.

The U. S. Geological Survey

Hon. George Otis Smith, Director of the U. S. Geological Survey, will tell how this Department is preparing to meet new conditions. Dr. W. A. Mendenhall, Chief Geologist, U. S. Survey, will describe the Colorado plan of cooperative geological survey, and G. F. Loughlin, Chief of Metalliferous Geology, U. S. Survey, will speak on Deep Mine Development at Cripple Creek. M. J. Gavin, technologist, U. S. Bureau of Mines, will describe initial operation of Government oil shale plant at Rifle, Colo.

H. Foster Bain, Secretary of the American Institute of Mining and Metallurgical Engineers, will tell the story of this organization's activities, and how its work can be made more helpful.

Other papers dealing with mining geology and the technology of the industries will be announced in advance of the convention.

American Silver Producers' Association

A meeting of the Board of Directors of the American Silver Producers' Association has been called to convene in Denver during the week of the convention. For the past two years or more this organization has been gathering first-hand information in the United States and foreign countries respecting the silver situation. The Association has probably now assembled for consideration more direct and vital facts bearing on this question than was ever before compiled by any other agency, either governmental or private.

The subject will be presented to the convention by one of the most competent, forceful and well-informed speakers in the country, who will speak of the "International Aspect of the Use of Silver As Money."

At this meeting will also be determined whether western silver producers are to continue their indifferent and half-hearted support of the pending Pittman Act, providing for the completion of silver purchases as contemplated by the former act, or whether by giving the measure now pending enthusiastic support ensure its passage when Congress reconvenes.

The American Mining Congress

James F. Callbreath, Secretary of the American Mining Congress, will tell how this effective organization has brought about unified effort in behalf of the industry by all of the allied industries engaged in the development of the mineral resources of the country.

The Western Division of the American Mining Congress

The Western Division of the American Mining Congress has a board of directors which is composed one one representative from each of the mining states, together with the secretaries of mining organizations, who meet annually or upon the call of the chairman, to agree on a working policy whereby concerted action by western mining men may be had on all public policies affecting the industry, particularly the activities of the American Mining Congress. The election of officers for the coming year, and other important business will be taken up at this meeting.

The American Association of Petroleum Geologists

The American Association of Petroleum Geologists will hold three half-day sessions during the convention. It is expected that a general program of geological subjects will be presented covering subjects of interest to the oil geologists on western midcontinent, Rocky Mountain and California Districts. These papers will give a regional account of the general geology, with some detailed description of local areas and a short summary of oil development.

Western Kansas, Western Oklahoma, and Western Texas will be discussed generally by a few papers in one half-day session. The general geology of the Rocky Mountain district and its relation to the oil industry, together with a few shorter papers on special stratigraphic or local problems, will be discussed in another half-day session, and the general geology of the west coast and its relation to the Rocky Mountain province will be presented at the third half-day session.

This meeting of the American Association of Petroleum Geologists is strictly a sectional meeting, under the auspices and with the assistance of the Rocky Mountain Association of Petroleum Geologists.

Mr. Charles M. Rath, of the Midwest Refining Co., is General Chairman of the Convention Committee.

Round Table Discussion

Several other speakers of national fame, in addition to the above mentioned, have been invited to speak on special subjects, and an opportunity for informal discussion of other problems will be afforded, among which will be:

Federal blue sky legislation;

Revision of Federal mining laws;

Federal legislation respecting stream pollution;

Surface rights to mineral land as affected by proposed Grazing Act;

Dangerous trend of compensation insurance legislation.

Reunion of Oldtimers

Colorado and Denver, from the earliest days of mining development, have always been an outstanding point of interest. From Denver the Argonauts took the trail to Clear Creek and Gilpin or the San Juan, Leadville, Aspen, Creede, or Cripple Creek, and thence to the four corners of the earth. From the Colorado School of Mines the engineer has gone to every important mining camp upon the face of the globe.

It is proposed that at the September meeting arrangements be made for a reunion of former residents of the state now engaged in mining development in other parts of the country, and plans are being perfected to make this reunion a prominent feature of the meeting.

A Cordial Invitation

Believing that the maintenance and further development of the mineral resources of the country are fundamental to national prosperity, and that cooperative effort of all those so engaged is essential in meeting the economic and governmental problems in connection therewith, the Western Division of the American Mining Congress, the Western Section of the American Institute of Mining and Metallurgical Engineers and the American Association of Petroleum Geologists, extend to their members and others interested a most cordial and urgent invitation to join in the meeting at Denver, Colo., September 20, 21, 22, 23 and 24, 1926.

If you are interested in the meeting and desire further information regarding the program or proceedings, or if you contemplate attending the convention, please advise the general or divisional secretary, in order that you may be kept informed of developments, and receive detailed program.

Come to Colorado for a vacation and business combined.

HISTORY OF EXPLOSIVES INDUSTRY IN AMERICA

A history of the explosives industry in America, the first of its kind ever prepared, will soon be published by the Institute of Makers of Explosives, of New York City. The authors are A. P. Van Gelder and Hugo Schlatter. Mr. Van Gelder is a graduate of the School of Mines of Columbia University and has been engaged in the explosives industry for 25 years, being for some time general superintendent of high explosives plants. Mr. Schlatter was at one time assistant explosives chemist of the Mine Accident Division of the Technologic Branch, U. S. Geological Survey, which later became the U. S. Bureau of Mines. He afterwards entered the smokeless powder manufacturing industry and has had a long experience in this branch of chemistry.

The new history will be a comprehensive volume of more than 1,000 pages, with about 400 illustrations. The authors have gone into their subject thoroughly. They have had the cooperation of all the explosives companies of the Institute, and have had access of records going back 124 years. The work will discuss in detail the history and use of black powder, nitroglycerin and dynamite, blasting supplies, smokeless powder, military explosives, and explosives in the making of America. This last topic will treat both in text and illustration of the uses of explosives in the mineral industry and in American engineering projects which have been built with the aid of explosives. An interesting feature of the work will be photographs of historic and important blasts.

There will be an introduction by Dr. Charles E. Munroe, Chief Explosives Chemist of the Bureau of Mines, who is recognized as one of the leading authorities of the world in his line.

The history will be published in a limited edition, and lists are now open for subscribers at the office of the Institute of Makers of Explosives, 103 Park Avenue, New York City.

A STANDARD FORM OF METAL MINE ACCOUNTING

A Committee Of The American Mining Congress Has Been Working For A Period Of Three Years Upon A Standard System Of Accounting For Metal Mines—The Following Article Is The Result Of This Study And Includes The Preliminary Recommendations

By T. O. McGRATH *

THE Committee on Metal Mine Accounting, of the American Mining Congress, respectfully submits a preliminary report of its recommendations for a Standard System of Accounting for Metal Mines. This report consists of a chart of General Accounts, numbered A to S, inclusive, No. I; an Income, or Profit & Loss Account, No. II; a Surplus Account, No. III; a Balance Sheet No. IV; a Production Cost Statement, No. V, and a Profit & Loss Cost Statement, No. VI. The Profit and Loss Cost Statement is optional. However, if such a Cost Statement is not finally recommended, the production credits should be shown as per Production Cost Statement (Smelting Ores) Metal Production, No. VII.

No agreement has been reached as to standard forms of Operating Cost Statements for departmental costs, such as mining, milling, smelting, or for any of the departmental units such as stoping, exploration or development, power, shops, etc. Due to the many variations in methods of mining and milling, and to the great variety of equipment used, it is doubtful if uniformity in Operating Cost Statements of metal mines would be practicable. It is believed, however, that much improvement can be obtained in the present accounting and cost methods, and that all expense at the mines can be summarized into five groups as shown by the first five items on Production Cost Statement (Smelting Ores) No. VII. A standard form of Operating Cost per Ton for Mining, summarized into these five groups and segregated as to Labor, Supplies, Power and Expense, would be practicable and of much value to the industry, to the operators, to those who invest in mines, and to those who value and assess the mines for tax purposes.

The committee wishes to stress the fact that a Production Cost must of necessity be a processed cost, and cannot be segregated as to Labor, Supplies, Power, etc., while an operating cost for any department or unit of the industry can be detailed as much as desired by each operator, both as to the departmental units and the elements of expense; however, it would not be practicable to try to cover in a recommended standard all details of the many methods of mining and treatment. Therefore, if any standard is worked out and recommended for Operating Costs, the major units of each department and the principal elements of expense only will be recognized.

It is hoped that a lively interest will be shown in this preliminary report, and that sufficient suggestions and criticisms will be received during the year 1926 to assure the committee that its final report will be acceptable and of value to the metal mining industry.

While no Schedule of Charges to the different accounts is submitted in this preliminary report, it is believed that the names and disposition of the accounts as shown by the Income Account, the Surplus Account, the Balance Sheet and the Cost Statements is sufficient for any one conversant with metal mine accounts and costs.

In the Chart of Accounts submitted all expense would be first assembled on the records and books each month as Current Direct Disbursements, accounts A-1 to 4, inclusive, and Accrued Disbursements, C-1 to C-4, inclusive, and then this expense would be subdivided so as to show on the records and books the Indirect Disbursements, the B-1-a to B-1-g, inclusive. These Disbursement Accounts would then be closed out by proper segregating and distribution to the Operating Departmental Expense Accounts, the Administrative Expense Accounts, Profit & Loss Expense Accounts, Deferred and Prepaid Expense Accounts, Asset Accounts and Production Inventory Accounts.

By assembling all expense into the three Direct Disbursement Accounts and the one Accrued Accounts Payable Account, an audit of all disbursements and expense can be accurately done in the least time and with the least expense.

As to the Operating Overhead Expense, this can best be carried as a lump sum if only one product is produced and there is only one method of operation.

However, if more than one major product is produced, such as copper and lead, copper and zinc, or lead and zinc, etc., or more than one method of treatment is involved, such as direct smelting ore and concentrating ore, or leaching ore, or several mines and plants, then the overhead must of necessity be distributed.

Therefore, it would appear that a uniform method of accounting and costs would need to provide for the distribution of the overhead, so that if operations involved only one product and one method and one mine and plant the overhead would be one charge against production, otherwise it would be distributed so as to show the cost of each.

Account D-11, Distributive Accounts, would be used only when there were more than one mine or plant, to allow for the distribution of any departmental operating expense applicable to more than one mine or plant. This account would not include any overhead expense.

The Oversales Account, J-6, is to take care of sales made ahead of production.

All the accounts shown on Chart No. 1, other than the Disbursement Accounts A, B and C, the Distributive Accounts, D-11, and the Oversales Account, J-6, are designed to reflect the results of operations, as shown by the Income and Surplus Accounts and the Production Cost Statements, or to show

The Committee on Metal Mine Accounting, under the Metal Mine Branch of the National Standardization Division, The American Mining Congress is composed of the following members:

L. S. Cates, Vice Pres. and Genl. Mgr., Utah Copper Co., Salt Lake City, Utah.

J. C. Dick, Mng. Engr., 511 Newhouse Bldg., Salt Lake City, Utah.

L. K. Diffenderfer, Sec. and Treas., Vanadium Corporation of America, 120 Broadway, New York City.

H. B. Fernald, Loomis, Suffern & Fernald, 50 Broad Street, NewYork City.

H. H. Miller, Genl. Auditor, Hercules Mining Company, Wallace, Idaho.

H. L. Norton, 27 Pearl Street, Medford, Mass.

Harry Vivian, Chief Engineer, Calumet & Hecla Cons. Copper Company, Calumet, Mich.

T. O. McGrath, Manager, Shattuck-Denn Mining Corp., Bisbee, Ariz.

This Committee, of which Mr. McGrath is Chairman, has been diligently studying the subject of a Standard Form of Metal Mine Accounting for a period of three years. Their recommendations are found in the accompanying article. The Committee wishes the criticism and suggestions of the industry in regard to this preliminary report, in order that their final recommendations may represent the best thought of the metal mining industry.

—The Editor.

* Manager, Shattuck-Denn Mining Corporation, Bisbee, Ariz.

No. I.—CHART OF GENERAL ACCOUNTS FOR METAL MINES

Disbursement Accounts

Current Direct Disbursements

Debit:

A-1 Labor.
2 Supplies.
3 Expense (bills audited).

Credit:

4 Current accounts payable.

Current Indirect Disbursements

Debits:

B-1 Indirect disbursements
- B-1a Power.
- B-1b Shops.
- B-1c Repairs.
- B-1d
- B-1e
- B-1f
- B-1g

Accrued Disbursements

Debit:

C-1 Accrued accts. payable. Credit:
- C-2 Reserve for taxes.
- C-3 Reserve for accidents.
- C-4 Bullion freight and refining not due.
- C-5 Selling expense not due.
- C-6 Etc.

Operating Departmental Expense Accounts

Debit:

D-1 Current exploration and development.
2 Ore extraction.
3 Ore transportation.
4 Ore concentration.
5 Transportation of concentrates.
6 Reduction and treatment.
7 Transportation of bullion.
8 Refining.
9 Selling.

10 Operating overhead
- D-10a Operating office.
- D-10b Insurance, fire.
- D-10c Insurance, accident.
- D-10d State and county taxes.
- D-10e Traveling.
- D-10f Management.
- D-10g Miscellaneous.

11 Distributive accounts.

Administrative and General Expense Accounts

Debit:

E-1 Salaries.
2 General office.
3 Legal and technical.

4 Advertising
- E-4a Allowable.
- E-4b Not allowable.

5 Donations
- E-5a Allowable.
- E-5b Not allowable.

6 Miscellaneous
- E-6a Allowable.
- E-6b Not allowable.

Profit and Loss Expense Accounts

Debit:

F-1 Interest paid
- F-1a On funded debt.
- F-1b On notes and accounts payable.

2 Nonoperating expense
- F-2a Stores.
- F-2b Hospital.
- F-2c Hotel and boarding houses.
- F-2d Refunds and discounts.

3 Loss on ———.

4 Federal taxes
- F-4a Income and profits taxes.
- F-4b Capital stock tax.
- F-4c War and stamp taxes, etc.
- F-4d

Deferred and Prepaid Expense Accounts

Debit:

G-1 Deferred development charges
- G-1a Mine development
- G-1b Other charges.
- G-1c

2 Prepaid insurance.
3 Replacements.
4 Suspense items.

Asset Accounts

Debit:

H-1 Mine property
- H-1a Purchase price.
- H-1b Development prior to production.
- H-1c General charges.

2 Construction and equipment
- H-2a Mine equipment.
- H-2b Concentration equipment.
- H-2c Reduction equipment.
- H-2d Transportation equipment.
- H-2e Refining equipment.

3 Materials and supplies.
4 Current accounts receivable.
5 Cash.

6 Investments
- H-6a Industrial stocks.
- H-6b Industrial bonds.
- H-6c Government bonds.

Production Inventory Accounts

Debit:

I-1 Ore on hand at cost.
2 Ore production expense.
3 Ore in process at cost.
4 Concentrates on hand at cost.
5 Concentrates production expense.
6 Operating production expense.

Production Revenue Accounts

Debit:

J-1 Unsold bullion in process and on hand at cost
- J-1a In process.
- J-1b On hand.

2 By-products on hand at inventory
- J-2a Gold.
- J-2b Silver.
- J-2c ———.

Credit:

3 Unsold bullion.

Debit:

4 Sold metal in process.
5 Sold metal on hand.
6 Oversales.

Credit:

7 Undelivered sales.

Debit:

8 Due for metal delivered.
9 Due for by-products delivered.

Credit:

10 Metal sales delivered.

11 By-products sales delivered
- J-11a Gold.
- J-11b Silver.
- J-11c ———, etc.

Debit:

12 Previous year's production.

Profit and Loss Revenue Accounts

K-1 Nonoperating revenue
- K-1a Stores.
- K-1b Hospital.
- K-1c Hotel and boarding houses.
- K-1d Refunds and discounts.

2 Investment revenue
- K-2a Dividends from stocks.
- K-2b Interest on bonds.
- K-2c Interest on deposits.

Deferred Revenue Accounts

L-1 Suspense items.

Capital Accounts

M-1 Capital stock outstanding.
2 Bonds issued.
3 Earned surplus.
4 Capital surplus.
5 Bills and notes payable.

Appreciation Accounts

Debit:

N-1 Appreciation of mine property.
2 Appreciation of equipment.

Credit:

3 Appreciation surplus (or reserve).

Depreciation and Obsolescence

Debit:

O-1 Depreciation of equipment.
2 Obsolescence of equipment.

Credit:

3 Reserve for depreciation.

Depletion

Debit:

P-1 Depletion of investment.
2 Depletion of appreciation.

Credit:

3 Reserve for depletion of investment.
4 Reserve for depletion of appreciation (or realized appreciation).

Profit and Loss

Q-1 Profit and loss account.

Dividend Accounts

Debit:

R-1 Dividend from earned surplus.
2 Dividend from depletion reserve.

Credit:

3 Reserve for dividend from earned surplus.
4 Reserve for dividend from depletion.

Surplus Reserve Accounts

S-1 Reserve for bond payments.
2 Reserve for stock payments.
3 Etc.

NO. II.—INCOME (OR PROFIT AND LOSS) ACCOUNT FOR YEAR 19—.

Memo. of Acct. No.				
J-10, 11	Metal sales delivered			$———
J-3, 7	Unsold bullion and undelivered sales		$———	
	Less:			
J-12	Previous year's production (Accts. J-3 and 7 for previous year)		$———	$———
	Gross production revenue			$———
I-6	Operating production expense		$———	$———
	Gross operating profit			$———
O-1, 2	Depreciation and obsolescence of equipment		$———	
P-1, 2	Depletion of investment and appreciation		$———	
	Capital returned			$———
	Net operating profit			$———
F-1	Interest paid		$———	
F-2	Nonoperating expense		$———	
F-3	Loss on abandoned prospects, etc		$———	
	Total		$———	
K-1	Nonoperating revenue	$———		
K-2	Investment revenue	$———	$———	$———
	Net income			$———
F-4	Federal taxes			$———
	Net earnings to earned surplus			$———

NO. III.—* EARNED SURPLUS ACCOUNT FOR YEAR 19—.

Memo. of Acct. No.				
M-3	Surplus January 1, 19—		$———	
Q-1	Net earnings for year		$———	
				$———
R-1	Dividends paid		$———	
S-1, 2	Reserves for ———		$———	
	Adjustments (as per detail accounts)		$———	$———
M-3	Surplus December 31, 19—			$———

* May be shown separately or as part of the balance sheet.

NO. V.—PRODUCTION COST STATEMENT, MILLING ORE, MONTH OF ———, 19—

Memo. of Acct. No.		Ore production: Expense	Ore production: Tons	Ore production: Cost, dry ton
D-1	Development	$17,452.00	96,808.	$2.4168
D-2	Ore extraction	216,511.93		
D-3	Ore transportation	27,864.80	96,808.	.2878
		$261,828.73	96,808.	
I-1	On hand 1/1/20	1,266.96	464.343	
		$263,095.69	97,272.343	
I-1	On hand 12/31/20	526.20	198.854	
		$262,569.49	97,073.489	$2.7049

Memo. of Acct. No.		Concentrate production: Expense	Concentrate production: Tons	Concentrate production: Cost, dry ton
I-2	Ore production	$262,569.49	97,073.489	$2.7049
D-4	Ore concentration	278,289.62	97,073.489	2.8668
		$540,859.11	97,073.489	$5.5717
I-3	Ores in process 1/1/20	241.87	50.00	4.8374
		$541,100.98	97,123.489	
I-3	Ores in process 12/31/20	289.58	50.00	
		$540,811.40	14,403.575	37.547
I-4	Concentrates on hand 1/1/20	37,925.49	1,042.787	
		$578,736.89	15,446.362	
I-4	Concentrates on hand 12/31	3,746.75	100.000	
I-5	Concentrate production	$574,990.14	15,346.362	37.547

Memo. of Acct. No.		Metal production: Expense	Metal production: Pounds recovered	Metal production: Cost per lb.
I-5	Concentrate production	$574,990.14	8,254.603	6.966
D-5	Freight on concentrates	83,395.86		1.010
D-6	Reduction and treatment	94,365.90		1.143
D-7, 8	Bullion frt. and refining	82,546.03		1.000
D-9	Selling	48,704.65		.590
D-10	Operating overhead	x.00		.00
G-1	Deferred development expense	x.00		.00
E-1-6	Administrative and general expense	x.00		.00
		$884,002.58	8,254.603	10.709

NO. VI.—PROFIT AND LOSS COST STATEMENT

Concluded

Month of ———, 19—

		Cost summary
I-6	Total operating cost	———c.
N-1, 2	Depreciation and depletion of operating investment	———c.
	Total production cost	———c.
J-11	Operating production credits	———c.
	Net production cost	———c.
F-1, 3	Nonoperating revenue, less nonoperating expense	———c.
F-4	Federal taxes	———c.
	Net profit and loss cost	———c.

the true condition of the business as reflected on the Balance Sheet.

The account numbers shown on the model Income Account, Surplus Account, Cost Statements and Balance Sheet are to guide the reader as to the disposition of the accounts. In actual published statements, of course, the account number would not appear.

The number of Accrued Accounts would depend upon how far the processing of the mine product is carried on the books. Some operators show the processing on the books of the mine product through the refinery and sales. Most of the large producers, however, show only the processing through the smelter and accrue all charges for bullion freight, refining and selling, while many of the small producers process up to the smelter and accrue the smelting or treatment charges as well as the bullion freight, refining and selling. Therefore, it would appear that a standard form of accounting should provide only for processing through the smelter and accrue all charges beyond that point. This would not require any change in the accounting of those who processed beyond the smelter and very little change by those who do not process through the smelter.

On the Balance Sheet, Capital Dividends are shown as a deduction from Appreciation Surplus. Of course, when all the Appreciation Surplus has been realized and distributed, or where there was no Appreciation Surplus, the Capital Dividends would show on the Balance Sheet as a deduction from Capital Stock and from Capital Surplus, if any.

In actual accounting practice, part of the accounting will be done at the place of production operations, and the remainder at the head office or in the treasurer's office, which requires that the records must be divided. The point where this division is made in the accounts is immaterial from the viewpoint of uniform accounting and costs. All that is required is an account on the operating books named "Treasurer's Account," and an account on the treas-

NO. IV.—BALANCE SHEET AT CLOSE OF BUSINESS DECEMBER 31, 19—.

Acct. No.	Assets			Acct.	Liabilities		
	CURRENT OR OPERATING ASSETS				CURRENT OR OPERATING LIABILITIES		
H-5	Cash	$———		A-4	Current accounts payable	$———	
H-4	Current accounts receivable	———		C-1	Accrued accounts payable	———	
J-8, 9	Due for metals delivered	———		M-5	Bills and notes payable	———	
J-4, 5	Sold metal in process and on hand	———		R-3, 4	Reserve for dividends	———	$———
J-1, 2	Unsold bullion at cost	———			INVESTMENT LIABILITY		
I-1, 3, 4	Ore and concentrates at cost	———	$———	S-1	Reserve for bond payments	$———	
H-6	SECURITIES INVESTMENT	$———		S-2	Reserve for stock payments	———	
	Stock of ———	$———			PROPERTY RESERVES		
	Bonds of ———	———		P-3	Reserve for depletion of mine property	$———	
	PROPERTY INVESTMENT			P-4	Reserve for depletion of mine appreciation	———	
H-1	Mine property	$———		O-3	Reserve for depreciation of equipment	———	$———
H-2	Construction and equipment	———			APPRECIATION RESERVE		
H-3	Materials and supplies	———	$———	N-3	Appreciation surplus	$———	
	APPRECIATION			R-2	Less capital dividends	———	$———
N-1	Appreciation of mine property	$———			DEFERRED CREDITS		
N-2	Appreciation of equipment	———	$———	L-1	Suspense items		$———
	DEFERRED CHARGES				TOTAL LIABILITIES		
G-1	Deferred mine development	$———		M-1	Capital stock outstanding	$———	
G-2	Prepaid insurance	———		M-2	Bonds issued	———	
G-3	Replacements	———		M-3	Earned surplus	———	
G-4	Suspense items	———	$———	M-4	Capital surplus	———	$———
	Total		$———		Total		$———

urer's books named "Operating Account," regardless of where the division is made.

PUBLIC LAND CLASSIFICATION

THE following statement summarizing the classification of public lands made by the Geological Survey during the month of June, 1926, is issued by the Secretary of the Interior.

Nearly 4,000 acres of land in Montana and Oregon were included in formal orders designating the land as nonirrigable under the enlarged-homestead acts and to that extent subject to entry as homesteads of 320 acres or less. Nearly 140,000 acres in Arizona, California, Colorado, Nevada, North Dakota, Oklahoma, South Dakota and Utah were classified under the stock-raising homestead law and designated for entry in tracts of 640 acres or less. Much of the acreage involved in these designations is included in original entries or in applications under the enlarged and stock-raising homestead acts which confer a preference right.

More than 1,000 acres in Utah were classified as valuable for power. A little more than 14,000 acres were eliminated from power-site withdrawal in Oregon, by orders of restoration and by reason of the interpretation of the withdrawals in terms of new survey. A former water-power designation in Oregon was canceled to the extent of 160 acres.

In Nevada and Wyoming 200 acres of land previously included in public-water withdrawal were restored to entry. The area so withdrawn was increased more than 2,000 acres in Montana and Oregon by reason of the interpretation of the withdrawal in terms of new survey.

NO. VII.—PRODUCTION COST STATEMENT, SMELTING ORES, MONTH OF ———, 19—

ORE PRODUCTION

	Wet tons	Cost, wet ton	Expense	Total
Stoping	———	———	———	
Exploration and development	———	———	———	
Maint. shaft and drifts	———	———	———	
General mining	———	———	———	
Operating overhead	———	———	———	
Total ore production	———	———		———
On hand ——— 1st	———	———		———
Total	———	———		———
On hand ——— 31st	———	———		———
Ore production shipped	———	———		———
Ore transportation	———	———		———
Total	———	———		———
In transit ——— 1st	———	———		———
Total	———	———		———
In transit ——— 31st	———	———		———
Mine copper production	———	———		———

METAL PRODUCTION

	Copper prod'n	Per pound	Per ton ore	Total
Mine copper production	———	———	———	———
Copper ore freight	———	———	———	———
Copper ore smelting	———	———	———	———
Bullion frt. and refining	———	———	———	———
Selling	———	———	———	———
Operating production cost	———	———	———	———
Production credits	———	———	———	———
Net operating production cost	———	———	———	———

PRODUCTION CREDITS

	Per pound copper	Per dry ton ore	Total
——— Ozs. gold @———	———	———	———
——— Ozs. silver @———	———	———	———
Refunds and discounts	———	———	———
	———	———	———

More than 13,000 acres in Colorado, previously defined as within the known geological structure of a producing gas field, were eliminated from such definition.

During the month of June the Geological Survey reported on the structural relations of lands embraced in 969 applications for prospecting permits under the oil sections of the leasing law of February 25, 1920, thus bringing the number of such reports rendered since the enactment of the law to 35,209. Nearly 400 such applications were pending in the survey June 30, 1926. During the month reports were rendered on 17 applications for coal prospecting permits and 6 applications for coal leases, making a total of 1,730 applications for coal permits and 772 applications for coal leases reported on since the enactment of the law.

INDUSTRIAL ACCIDENT PREVENTION CONFERENCE

The Department Of Labor Conducts An Important Safety Convention Which Is Attended By Leading Men In Industry, Including Representatives Of The Coal And Metal Mining Industries —A Review Of The Discussions Of Interest To Mining

UNDER the auspices of the United States Department of Labor an industrial accident prevention conference was held at the Mayflower Hotel, in Washington, D. C., July 14-16. Many leading industrial enterprises were represented, and the papers presented a wealth of information from both statistical and economic standpoints. The American Mining Congress was represented at the conference by Howard I. Young, American Zinc Co., Mascot, Tenn.

Secretary of Labor, the Hon. James J. Davis, called the conference for the purpose of interesting industrial leaders and the representatives of the workers, in a unified campaign for reporting accidents, and to stimulate a greater activity in measures to reduce the annual toll of death and injury from accidents.

The mining industry was well represented at the conference with delegates attending from coal and metal mining companies, and from the iron and steel industry. Considerable credit for accident prevention work was given to the mining industry, by the speakers on the program.

Interesting papers concerning mining were given by T. F. Jennings, of the Utah Copper Co., and W. W. Adams, statistician of the United States Bureau of Mines.

In part Mr. Jennings said:

"There is, there can be no greater, grander, nobler aim than that of alleviating, and so far as humanly possible, preventing, the pain, sorrow, and misery of life incident to industrial activity. In the short space of 20 years the movement to prevent industrial accidents has become almost universal in its influence, and is a recognized integral part of every modern up-to-date industrial organization. This is true of the Utah Copper Co., with which I am connected, and which company operates at Bingham Canyon, the largest open cut copper mine in the United States, and operates at Magna and Garfield, reduction and concentrating mills having a capacity of 40,000 tons a day.

"Our safety work begins at the time the man is employed. He is required to take a physical examination. The purpose of that examination is not to reject applicants who are physically imperfect, but rather to prevent their employment in particular kinds of work for which they are physically disqualified.

"The next step in accident prevention is education. Recognizing that mechanical appliances play but a comparatively small part in accident prevention, and that the greater proportion of accidents is attributable to the human factor, an effort is made to arouse the interest of the worker in the safety of himself and his coemployes. The individual worker is taught that his safety depends largely upon himself, and that the safety of others depends upon himself, and that the safety of the men comparatively is but a massing of the units of the individual. He has impressed upon him the necessity for constant vigilance and every effort is made to teach him the catechism of carefulness. This is done through the distribution of safety articles, posters, calendars, etc., which describe and depict the causes and consequences of accidents, and carry messages of caution. There is a General Safety Council consisting of the management and the superintendents of the mine and plants. Immediately under that General Council is the Safety Council of the individual mine or plant, composed of the heads of all departments in the respective plants. This committee meets monthly and discusses the accidents occurring during the month, and a means of avoiding those accidents. The next link in the chain is the Departmental Safety Committee, consisting of all foremen in the given department, and one workman for each gang or group in that department. The Departmental Safety Committee meets twice monthly to discuss current accidents and methods of avoiding them. Each Departmental Safety Committee appoints a safety man, whose primary duty, at all times, is to be watchful for unsafe or dangerous practices, appliances, places or conditions, and to receive reports concerning the same from the workmen. This safety man wears a large button to identify him. The minutes of the meetings of all the committees are taken down in writing and distributed to the members of all other committees engaged in the safety work. This enables each department to keep in touch with every other department in this activity. The work of these committees is supplemented and facilitated by the plant employment director, who gives every man, at the time of his initial employment, a short talk on safety and the aims and practices of the company in its endeavor to prevent accidents, and instructs him how to report anything which he observes and considers might be unsafe. Similar instructions are given the employe by his foreman on being first put to work. All accidents are carefully investigated and reported by the employment director, and analyzed with the view to preventing a recurrence of a similar accident.

"As a part of the so-called educational feature of the program, I, as superintendent of that foundry, personally talk to each man as he is put to work there, and impress upon him the necessity of his being careful and cautious. Furthermore, I emphasize the rule of the company, requiring each man to immediately report to the plant doctor every injury however trivial it may appear to be; pointing out that experience has demonstrated that many injuries of apparently inconsequential nature unless promptly and properly cared for, may result in serious and extended disability; thus the results of accidents are minimized. I also require every man, meeting with a minor accident in that foundry to personally appear before the Departmental Safety Committee of the foundry, and explain how, why and under what circumstances that accident occurred, to the end that the same thing should not happen again if avoidable.

"Whenever the Departmental Safety Committee finds that an accident has been caused by any mechanical defect, or danger incident to any place of employment in the foundry, that committee forthwith so reports to me, as superintendent of the foundry, and I immediately take steps to have the situation rectified. The work of the Departmental Safety Committee is augmented by that of a special Foundry Equipment Inspection Committee, composed of experienced foundrymen, appointed by me on that committee in recognition of their qualification and competency to pass upon the safety of the various machines, appliances and tools involved in the foundry operation."

D. J. Price, of the Department of Agriculture said shale, limestone, gypsum and other inert dusts are not explosive. He said there have been dust explosions in sulphur grinding plants and in aluminum, magnesium, zinc and similar metallic dusts.

"The great progress in accident reduction which has been accomplished in the steel industry during the last 15 years can be traced to the collection and

© Underwood & Underwood

The wind in the willows along the Potomac

analysis of accident records by that industry, and the attention given by the Department of Labor to the accident experience of that industry," said R. H. Lansburgh, secretary of labor and industry of Pennsylvania. "Statistics for machine shops and blast furnaces must be separated because the hazards are different."

W. H. Cameron, of the National Safety Council, said that organization is collecting accident statistics in the chemical, metals, and petroleum industries. He said mining companies report their accidents to the Bureau of Mines. Nine companies in the chemical industry showed decreases of 29 percent in accident frequency and 27 percent in accident severity for 1923 and 1924. Fifteen petroleum companies had increases of 19 percent in frequency and 20 percent in severity in 1922 and 1923. In the metals industry 77 companies had decreases of 15 percent in frequency and 2 percent in severity in 1923 and 1924.

L. A. Deblois, of the national bureau of casualty and surety underwriters, said the value for minor injury cases is taken from the experience of seven plants of the du Pont Co., which consistently reports such injuries. He said the expectancy of a non-injury accident from smoking over an open powder keg would be low, while that for smoking over a can of heavy oil would be high.

Safety Museum

Secretary of Labor Davis recommended creation in his department of a bureau to cooperate in gathering and distributing accident statistics for industries, and establishment of an industrial safety museum in Washington to exhibit efficient safeguards for workers. Secretary Davis said that employers are "concerned in the safety and health of the workers." He stated that it is shown from the experience of the Bureau of Mines, Interstate Commerce Commission and Bureau of Labor Statistics that a bureau is needed in the Department of Labor to bring together in useful form data on accidents from every source. He stated that the iron and steel industry has made remarkable strides in cutting down losses due to accidents. Secretary Davis referred to statistical activities of Federal agencies which for many years have kept elaborate records of accidents in mines and on railroads. "These records, carefully kept and thoroughly analyzed, have been a most important factor looking toward accident reduction in these industries." "The experience gained will help in the attack on accidents in other lines."

Secretary Frank Morrison, of the American Federation of Labor, said responsibility for accident prevention in the coal mining industry rests on the employers and state governments. He stated that in the last 10 years more than 25,000 miners have been killed in coal mine explosions in this country. He referred to rock dusting as an adequate method of preventing coal dust explosions. He quoted the Bureau of Mines as saying in 1924 that although it recommended rock dusting, only a few operators, one in Colorado and several in Illinois, had adopted it to a limited extent.

Rock Dusting

"Some progress has been made in rock dusting since then, but large numbers of miners are subjected to dangers of explosions because the mining companies refuse to accept the recommendations of the bureau to install rock dusting systems," said Mr. Morrison. "Rock dusting can be made compulsory by state legislatures. To the extent that it is not compulsory, the state legislatures are responsible for the death of miners in mine explosions.

"Responsibility of mine accidents due to explosions rests on corporations who own mines and refuse to install rock dusting systems and on state legislatures who refuse to enact compulsory legislation," concluded Mr. Morrison.

Leonard W. Hatch, of the New York Department of Labor, said the figures on accidents in the iron and steel industry prepared by the Federal Department of Labor are the best accident statistics in the country. He said it is easier to get figures from this industry because its workers are centered in large plants.

Mine Delegates

S. D. Warriner, of the anthracite operators conference, was unable to attend the meeting as he was called to California. The following represented anthracite operators at the conference:

F. C. Caldwell, Philadelphia and Reading Coal and Iron Co.; George R. Beehler, Glen Alden Coal Co.; T. E. Snyder and E. P. Humphrey, Hazle Brook Coal Co.; Edward Griffith, Lehigh and Wilkesbarre Coal Co.; Fred C. Benfield, Lehigh Valley Coal Co., and H. M. Smyth, St. Clair Coal Co.

Others attending the conference were: H. I. Young, American Zinc Co., Mascot, Tenn.; B. F. Tillson and H. N. Dambmann of the New Jersey Zinc Co., New York; G. J. Barrett, of Michigan, representing the Oliver Iron Mining Co.; O. H. Wilcox, of the West Kentucky Coal Co.; R. V. Ageton, of the Tri-State Zinc and Lead Ore Producers Association, Miami, Okla.; L. J. Bowker, of the Mine Safety Appliances Co., Philadelphia; Theodore Marvin, of the Hercules Powder Co., Delaware; N. S. Greensfelder, of the Explosives Engineer, Delaware; E. R. Coombes, of the American Mining Congress; Dr. R. R. Sayers, chief surgeon, F. G. Tryon, statistician, and J. J. Forbes, of the Pittsburgh station, Bureau of Mines; Robert J. Young, of the Illinois Steel Co.; H. W. Mowery, of the American Abrasive Metals Co., New York; C. L. Close, of the American Iron & Steel Institute and U. S. Steel Corporation, New York; J. M. Woltz, of the Youngstown Sheet and Tube Co.; J. J. Walsh, superintendent of mines of Pennsylvania; F. E. Blank, of the Jones and Laughlin Steel Co., Pittsburgh; J. E. Culliney and J. M. Larkin, of the Bethlehem Steel Co., and A. H. Matlach, of the Wheeling, W. Va., Steel Corporation.

The following resolutions were adopted:

Resolution No. 1

WHEREAS, the conference on industrial accident prevention called by the Hon. James J. Davis, Secretary of Labor, has been most beneficial and will undoubtedly result in great improvements in industrial wastage of men and money to the ultimate good of all; Therefore be it

Resolved, By this conference assembled July 16, 1926, that the high appreciation and thanks of the delegates here assembled be extended the Hon. James J. Davis, Secretary of Labor, and his most able assistant, the Hon. Ethelbert Stewart, Commissioner of Labor Statistics, for their constructive and humane contribution to the welfare, progress and prosperity of America's greatest assets, her productive units both human and material; be it further

Resolved, That a copy of these resolutions be presented the Hon. James J. Davis, the Hon. Ethelbert Stewart, and a copy be furnished the press.

Resolution No. 2

WHEREAS, statistics are an indispensable aid to most effective accident prevention, and national accident statistics are of fundamental importance for most dependable comparisons of experience, and

WHEREAS, it is necessary for state governments to collect accident statistics in the several states in connection with their own accident prevention work and administration of compensation law, and duplicate reporting of data by employers to state and Federal authorities should be avoided as far as possible, and

WHEREAS, it is entirely feasible for state departments of labor to collect the original data from employers and furnish copies to the Federal Department of Labor as needed for statistics on a national scale; Therefore be it

Resolved, That this conference recommends that a system of national accident statistics should be developed as rapidly as possible by the following plan:

1. Standard and uniform data to be prepared in each state by the Department of State Government dealing with such matters and copies thereof be furnished to the Federal Bureau of Labor Statistics, which bureau shall promptly transmit such records and information to the other governmental agencies interested.

2. The data in general to be standardized and made uniform in the several states by compilation so far as possible in accordance with the definition, classification and (*Continued on page* 597)

STATISTICS FOR ACCIDENT PREVENTION IN AMERICAN MINES

Causes Of Accidents About 25 Percent Mechanical and 75 Percent Human—Hence Greatest Progress In Reducing Accidents Depends Upon Human Factor—Statistical Records Make It Possible To Arouse Competitive Spirit—Uniformity Of Methods In Gathering Statistics Important

By W. W. ADAMS *

THE chief object in the compilation of accident statistics is to aid in the prevention of accidents. In and of themselves, statistics have no reason for being; and unless the use to be made of them is important the cost of compiling figures is likely to be unjustifiable. On the other hand, when confronted by a problem that can not be solved without the aid of statistics, it would in ordinary cases be ridiculous not to obtain the information needed, and in situations where human life is at stake, it would be criminally negligent. It may be said to the credit of the mining industry that it was among the first, if not the very first, to compile accident records on an extensive scale and to use such records as an aid in the prevention of accidents.

As early as 1870—more than half a century ago—the State of Pennsylvania began to keep records of accidents that occurred in the anthracite mines of that State. Four years later Ohio began the keeping of similar records. The next year accident records became available for Maryland. In 1877, the legislature of Pennsylvania broadened the mine inspection law to include the bituminous mines in the central and western portions of the State. Iowa undertook the work in 1880, Indiana in 1881, Illinois in 1882, Colorado and West Virginia in 1883, and Kansas and Kentucky in 1884. Thus for more than 40 years the production of the major portion of the Nation's annual coal supply has been accompanied by the keeping of accident records and by the use of the information revealed by such records in the task of lessening the danger under which mining operations are conducted. In spite of all that has been done, accidents in mines continue to occur in large numbers. Increasing production and development of underground operations over larger areas to meet the Nation's needs for coal, create new hazards in the mines. Wider areas of roof are exposed, haulage operations have increased in volume and speed, mining machines for undercutting the coal have been rapidly installed, and more explosives are being used. Hence the conditions prevailing in the industry today are radically different from those under which coal was mined in earlier years. To keep pace with the development of the industry with its increasing hazards, more detailed information regarding accidents has been found essential.

The Federal Bureau of Mines was organized in 1910. Shortly after its organization preparations were made to obtain statistics of accidents for all branches of the mining industry. The first inquiries were for 1910 and related exclusively to coal mines, not only because the coal industry could more readily furnish the information but mainly because coal mining employs about three-fourths of all mine workers in the country and suffers at least that proportion of the accidents that occur each year. Schedules requesting accident data for 1910 were mailed early in 1911 to all coal operators in the United States. In the following year similar schedules were mailed to coal mines, metal mines, and quarries. The bureau therefore now possesses accident statistics of national scope for all mines and quarries in the United States for a period extending over 15 years. The data for metal mines and quarries relate to injuries as well as deaths. The figures for coal mines relate to fatal accidents only. It was deemed necessary in the early stages of the work to obtain statistics of coal mine accidents at more frequent intervals than once a year. Therefore an arrangement was made with the coal mine department of each State to furnish the bureau with monthly reports of accidents in coal mines. The monthly reports were restricted to fatal cases only, because it was impracticable to obtain at such frequent intervals satisfactory figures on injuries which in many cases involved disability over long periods of time. This arrangement brought the bureau in close touch with the State mine inspector but it had the effect of sacrificing the work of collecting annual reports from operating companies. Within the past two or three years the bureau has had the cooperation of seven hundred typical coal mining companies in an intensive study of accidents, and the information from these companies covers all lost-time accidents as well as fatalities. These special returns are extremely valuable in the bureau's statistical work as they supplement in many ways the less complete reports that relate to fatalities only.

From the bureau's statistical studies we have found that the death rates in coal mines vary considerably from State to State. To know this bare fact would avail little if the statistics did not enable us to go further and learn the particular classes of accidents in which the differences in the rates existed. For example, during 1921 to 1924, the latest four-year period for which complete figures are available, the average death rate from all accidents in coal mines in the United States was 1.88 per million man-hours of exposure. The rates ranged from such low levels as .47 and 1.16 for Texas and Missouri, respectively, to as high as 7.24 for New Mexico and 10.37 for Utah. A further examination shows that the higher rates were mainly due to large explosions in New Mexico and Utah during the period covered by the figures; also, to a less extent, haulage accidents and falls of roof and coal.

Again, the bureau's statistical studies show that the average temporary injury occasions a loss of between 14 and 15 days by the injured employe, a period of time during which nearly 60 tons of coal might have been produced, since the production of coal in the United States is around four tons per day for each man employed. From other statistical studies the bureau has found that the amount of time lost by injured employes, or rather the length of their disability measured in calendar days, is equivalent to between 8 and 10 percent of the total man-days worked in coal mines and metal mines, and between 5 and 6 percent in the stone quarry industry. This is a rather severe economic waste when it is remembered that many of the accidents are preventable.

In the keeping of accident records it is quite essential that the records cover all of the accidents that occur. The importance of complete reports is indicated by a statistical analysis of records furnished to the bureau by several hundred metal mines and coal mines. These statistics indicate that, unless accident studies are based upon complete records, conclusions drawn from the records are apt to be misleading. Moreover it is difficult if not impossible to compare the accident experience of one mine or State with that of another mine or State unless the same classes of accidents are covered in both cases. It has been

* Statistician, Bureau of Mines, Department of Commerce. Presented at the Industrial Accident Prevention Conference, Washington, D. C., July 16, 1926.

found, for example, that 40 percent of men injured in coal mines are disabled for one week or less. In other words if only accidents disabling an employe for more than one week are included in our studies, we are ignoring about 40 percent of the accidents which actually occur. Hence the accident rate of one company may falsely appear to be better than that of another company for no other reason than that the first company bases its rate on something less than the whole number of injuries to its men. In like manner it has been found that States or companies keeping no records of accidents unless the injured employe loses more than two weeks' time, are thus maintaining records that are only 35 percent complete. The lessons that might be learned from the other 65 out of every 100 accidents are entirely lost. It is as if an insurance company should ignore 65 percent of the cases of sickness among its policy-holders and base all of its research work on reports covering only 35 percent of the cases.

As previously stated, accidents cause a loss to the coal industry which is equivalent to 8 or 10 percent of the entire amount of time which the industry works. This means that the accident-severity rate for the industry is around 10, representing 10 days lost per thousand man-hours of exposure. This loss represents the average for the industry. It emphatically does not indicate the best that can be done by individual companies. Again we are indebted to statistics for our knowledge that in 1925 certain coal mines had severity rates considerably below 10. The bureau's records shows that one anthracite mine in Pennsylvania, for example, had a severity rate of only 0.27. A bituminous mine in West Virginia had a rate of only 0.32. A zinc mine in Oklahoma had a severity rate of 0.23 as compared with an average rate of 9.07 for the group of metal mines under consideration. The average rate for the quarry group was 7.60, yet several quarry plants went through the entire year without any employe losing a single day from personal injury. The group of mines producing non-metallic minerals by underground mining methods had an average rate of 7.34, yet one company in the group had a rate of only 0.004.

These are typical cases of what can be done by accident prevention effort and what can be revealed by statistical studies. Each mine referred to by these records employed a minimum of 50 men underground; one mine employed as many as 400 men. Each quarry employed at least 25 men inside the pit. The accident rates quoted have reference to strictly mining and quarrying operations and include only such surface operations as are directly connected with mining and quarrying. The figures do not cover milling and smelting nor do they cover the manufacture of lime or cement.

The element of competition is one of much importance in accident-prevention work. Since the causes of accidents are about 25 percent mechanical and 75 percent human, it is manifest that the greatest progress in reducing the accident rate is dependent on the success met with in dealing with the human factor. The desire for leadership in accident prevention work by miners and mining companies is quite as natural as in other lines of effort, as in sports, studies, science and finance. Statistical records make it possible to utilize a natural sporting and competitive spirit in the laudable effort to prevent industrial accidents. A safety contest to establish the lowest individual accident rate can only be conducted by placing the data for all industries on a correct and uniform basis. Thus the competitive spirit in such a contest may be utilized in bringing about uniformity in accident reporting. Under present conditions, hardly any two States compile their accident statistics in the same way. Not only do the States differ in their methods of compiling statistics, but they also differ widely as to the classes of accidents that must be reported to State officials and as to the classes of accidents covered by their statistical reports. It is conceded that individual States may find it necessary to make special compilations for local needs, but a wide field exists where uniformity is desirable in the interest of safety work in all industries in all States.

The humanitarian point of view in the prevention of personal injury in the American industry should in itself prompt everyone to action. In addition, however, there is also the financial appeal. It may be assumed that industry at large is paying sufficient money in the form of insurance premiums to meet the cost of compensation for the accidents that occur. Yet there is not the same assurance that any specific industry is being charged insurance premiums in keeping with its hazard as compared with the hazards of other industries. It is quite probable that certain industries are paying higher premiums than their relative hazards would justify, and that uniform statistics in all industries would reveal the fact and bring about more equitable insurance rates. The fact that compensation for accidents is based on pay roll exposure, a very unstable factor, instead of being based primarily on man-hour exposure is likely to obscure the relative hazards of different industries. It is here that statistics offer a means for correctly comparing the hazards of one industry with those of another. Unless the element of comparability is present, compilations of figures do not constitute statistics of the kind needed in accident prevention work. Some present compilations having to do with accidents and compensation for accidents in various States, for example, may be considered to be statistics only within State boundaries. As soon as the figures cross the boundary of the State to which they relate, they cease to be statistics and become merely compilations of figures which can not be compared with figures for adjoining States. A different language spoken in the 48 States would perhaps cause but little more confusion in matters in general than we now have in statistical matters when we try to reconcile or compare the accident records of one State with those of another State. I refer to statistics needed to compare the frequency and severity rates in different States and in different industries. One of the greatest contributions that could be made to industrial safety would be the adoption of a universal statistical language in all States.

It is to be hoped that this conference called by the Secretary of Labor will result in an early agreement as to what shall be considered a reportable accident and what shall be the basis for calculating frequency and severity rates. A further development to be hoped for is the determination by every agency represented here, as well as industrial concerns throughout the country, to place their accident records on a uniform basis so that the lessons to be learned therefrom may be available to all. It is strongly urged that the mining industry take the lead in this improvement in accident statistical records as it took the lead more than 50 years ago in inaugurating this important work.

During the first six months of the current year the accident records of the Bureau of Mines show 1,137 fatalities; those for the corresponding period last year showed 1,148. The six months tonnage was 303,760,000 and 279,248,000, in the two years respectively. These figures indicate a fatality rate of 3.74 per million tons for the present year and 4.11 for the first six months of 1925, a reduction of 9 percent. The six months' fatality rate for bituminous mines alone was 3.61 per million tons, with a production of 267,506,000 tons, as compared with 3.67 and an output of 234,886,000 tons in the same period of 1925. While the bituminous rate remained practically the same for the two years there was a decrease of nearly 27 percent in the anthracite rate which was 4.69 and 6.42 respectively, based on a production of 36,254,000 and 44,362,000 tons of coal. However, this noticeable decrease was due partly to the strike in the anthracite field when the mines were closed down during January and part of February.

ROOF CONTROL AND MINING METHODS

Recent Developments In, And Elements Of, Roof Control, Together With Roof Control On Long Faces, And In The Eagle Seam, Were Discussed At One Session Of The Recent Cincinnati Convention Of Practical Operating Men

***L.E. YOUNG,** General Manager, Union Colliery Co.,* as chairman of the session devoted to a discussion of roof-control problems, said: "We are gathered here this morning to consider the general subject of roof control, which is very much related to the subject of mechanical loading underground and conveyor systems of mining. Some of us have been studying surface subsidence for many years, but only relatively recently has there been a real intensive study made of the problems of roof control in its relation to mining operations."

ELEMENTS OF ROOF CONTROL

***H. F. McCULLOUGH,** Engineer, H. C. Frick Coke Co.:*

"In the first attempts to apply mechanical loaders to coal mining it was recognized that the generally prevailing room and pillar systems of mining imposed serious limitations on the realization of the full possibilities of the loading machines themselves. Numerous loading machines have been developed to the point where they are mechanically satisfactory, but the limitations imposed upon them by the inherent characteristics of room and pillar mining still persist.

"Productivity is conditioned by the proposition of the total operating time that the loading machines can be kept loading coal. With the room and pillar system of mining there is only a relatively small amount of coal to load out from each working place. This makes it necessary to move the loading machine from place to place and correspondingly reduces the time for which it is available for productive work.

"Even when the loading machine has ready-to-load-out coal in front of it, the intermittent nature of the car supply introduces delays which still further reduce the productive working time, not only of the loading machine but of its crew and those dependent upon it.

"Consideration of the difficulties imposed on machine loading by the room and pillar system of mining lead to the belief that the long-face and the general arrangement of longwall system of mining offered the solution to both of the major difficulties. The long-face afforded a supply of coal in one place sufficiently large to keep the loading machine productively employed for a large proportion of the total working time. The facility with which it was possible to run conveyors from the loading unit to a point where the trip of mine cars could be moved under the discharge point of the conveyor in a continuous string offered a solution to the problem of securing continuous transportation of the coal away from the loading machine.

"Those who embarked upon these so-called longwall operations without gob packing generally encountered difficulty in controlling the roof and in keeping a space open in front of the faces sufficient to permit the operation of the loading machines.

"The difficulties encountered in these attempts to maintain longwall faces open without gob packing and in such condition as to permit the economic employment of loading machines has influenced operators to arrange their workings in a series of relatively short faces stepped with relation to each other. By resort to the well known stepped face arrangement as a means of establishing roof control, the object is to maintain such working face conditions as will permit keeping open in front of the faces a space sufficient for the operation of the loading machines.

"It has also been found that with rapid rates of movement of the working faces the improvement of working face conditions and the concentration of the active mine area which results therefrom, and the more effective employment of the loading and transportation equipment, is facilitated by an arrangement consisting of a series of short stepped faces instead of a single longwall face of a length equal to the aggregate length of the series of short faces.

"This arrangement, composed of a series of relatively short faces, or a 'long-face' working, as it has come to be called, is nothing more, so far as the principles of control are concerned, than the old board-and-pillar system of mining, with a new name. The lrst or development working consists of driving relatively narrow headings on relatively wide centers. This divides the solid block or panel of coal into a number of long pillars. The second or productive working consists of drawing these long pillars back by some method of long-face working on their ends or butts.

"The bord-and-pillar system of mining affords a means of controlling a wide range of roof and working face conditions. The principles of the control of bord-and-pillar operations has been fully developed, and was well understood when this method of working was more generally employed than it is today. A study of the basic principles of the control of bord-and-pillar workings will be found to be extremely helpful in the development of mining arrangements for long-face workings for use with mechanical loading equipment.

"The difficulties previously experienced with bord-and-pillar workings arose principally from the fact that the hand methods of mining and loading which prevailed at the time made the progress of the work extremely slow, and hence precipitated many difficulties which will be eliminated with the much faster methods of working available today. The much faster rate of movement of the working faces that it is possible to obtain with present day mining, loading and transportation facilities permits of working the coal out of a properly arranged long-face working before the difficulties formerly encountered have had time to manifest themselves.

Length of the Break Line

"The first requirement in a successful long-face working is that the panel of workings composing a unit of operation shall be wide enough to produce a break line long enough to cause the overlying strata to subside or cave sufficiently to relieve the standing coal adjacent to the mined-out area from the load of the strata overlying the mined-out area.

"If this loading of the adjacent standing coal is not relieved until the overlying strata has broken to the surface, then the break line must be made long enough to cause breaking to the surface, but if the load on the adjacent coal is relieved before the overlying strata has broken all the way to the surface, then it is not necessary to have the break line long enough to cause surface breaks.

Rate of Movement of the Working Faces

"The second requirement is that the working faces shall be moved fast enough to keep the working space along the faces in freshly mined areas where the forces brought into action by the removal of the coal have not had sufficient time to manifest themselves. The faster the working faces are drawn back, the shorter the time the scene of mining operations occupies any particular area and the less the forces acting have manifested themselves. There may be too fast a rate of working in certain cases, bumpy coal, for example, but generally speaking faster rates of movement of the working faces tends to transfer the seat of trouble back into the gob.

Arrangement of the Working Faces

"The problem of successful mechanical loading resolves itself into one of controlling the coal seam, floor and roof conditions at the working faces. But these conditions are simply manifestations of the roof pressure. The roof pressure and its distribution in any case, at a given rate of face movement, can be largely influenced, in bord-and-pillar or long-face mining, by the proportions and arrangement of the workings.

"Hence, the third requirement is that working faces be so arranged as to minimize or control the pressure exerted upon the coal, face timbering and headings in the region of the working faces.

"The stepped face arrangement which characterizes bord-and-pillar and long-face workings brings about a set of conditions which permit keeping open the space along the working faces needed for the operation of the mechanical loading and conveying equipment, and which facilitates the control of the working face conditions.

"Figure 1 shows a panel of long-face work with the faces stepped in relation to one another. The sides and ends or faces of the pillars form the boundary line between the gob and coal and the zig-zag or stepped line formed by the successive pillar sides and ends may be said to constitute the absolute course of the gob line. But the general trend of the faces is indicated by a line such

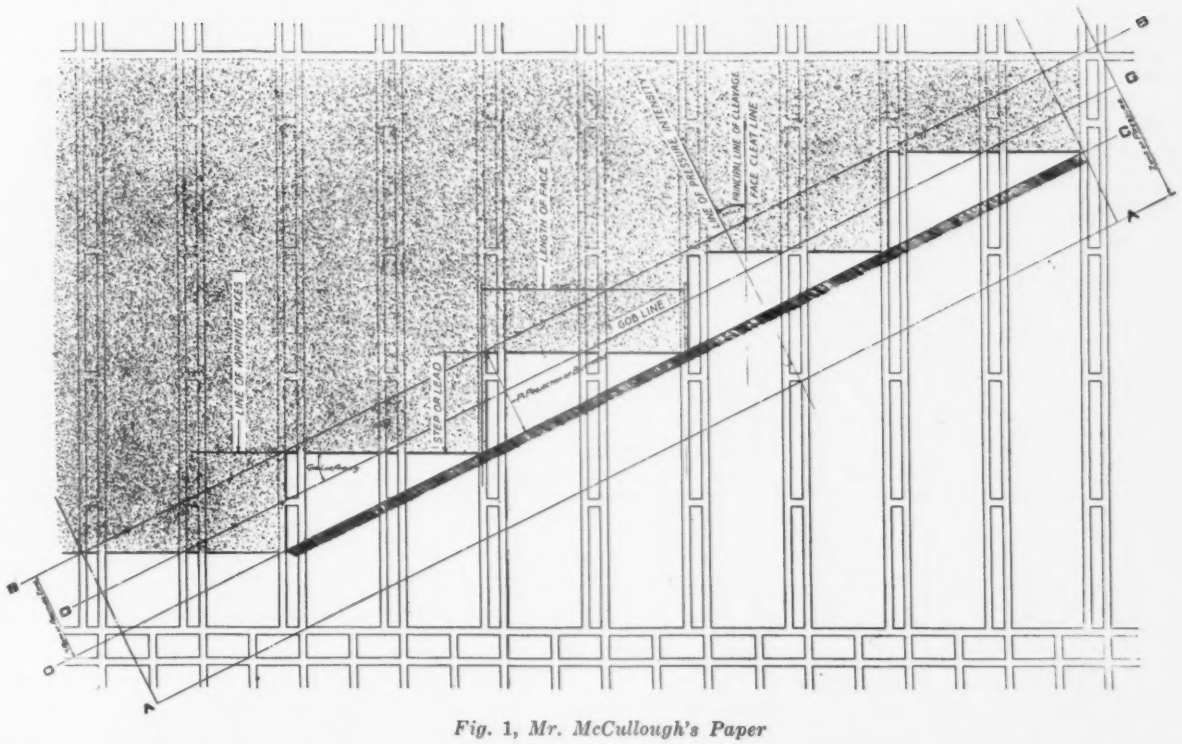


Fig. 1, Mr. McCullough's Paper

as GG drawn through the center points of the pillar ends or faces and hereinafter called the gob-line. As the pillars are drawn back by the working of their ends, the main body of the strata overhanging them tends to break off along a line (BB) paralleling the gob line but located farther back toward the gob.

"In general, it is only after the first major falls of roof strata into the gob have occurred that the full 'weight' or pressure caused by the overhanging strata is exerted upon the coal. Thereupon, the strata overhanging the coal faces and extending back over the coal for some distance acts as an overhanging ledge or lever. Under the influence of its own weight this overhanging ledge of strata tends to deflect downward and thus exerts a pressure upon the coal which underlies it. This pressure is made manifest by the crushing of the coal along the face and back over the pillars of coal for some rather definite distance, as, for example, to A-A in Fig. 1. This pressure is greatest at the coal face and runs out to nothing at the limit of crushing, indicated by the line A-A.

"This subsiding ledge of overlying strata is thus underlaid by the ends of the pillars of coal. These pillars resist the downward movement of the overhanging ledge of strata and thus act as supports thereof.

"If the pillar ends were worked off diagonally along the line C-C, the result would be an equivalent of the long single face characteristic of true longwall working. This, so far as concerns the control of working face conditions, represents the arrangement which has characterized most of the so-called longwall operations designed for use with mechanical loaders. It really amounts to an attempt to work longwall without the use of gob packing for the control of face conditions. In the laying-out of workings along these lines it is not generally appreciated that the maintenance of the long straight face is largely dependent upon the gob packing to control the roof and to maintain the working space along the face open. Most of the attempts to work longwall without gob packing are really attempts to work longwall without the means of control which make longwall operations possible. The break line is precipitated upon the working faces, instead of being kept back in the gob, and the space required in front of the working face cannot be kept open.

"In the long-face or bord-and-pillar method of working, the ends of the pillars are maintained so that their outward corners project out from the line C-C and towards and into the gob. The result of this arrangement is that these outwardly projecting corners of the pillars act as buttresses which support that portion of the overhanging ledge of roof strata which lies between the lines B-B and C-C. This tends to cause the break line of the roof strata to form along the line B-B, instead of along the line C-C, as was the case with the straight face resulting from working the pillar ends off along line C-C. By this arrangement the space required along the working faces is ahead of the break line and under uncaved roof, and hence may be kept open without entailing undue expense.

"It is these buttresses of coal and their action in maintaining the integrity of the roof strata between them which renders the long-face or bord-and-pillar method of working adaptable for use with mechanical loaders under conditions where operation of the single-face longwall method with unpacked gob areas is impracticable.

"A wide range of working conditions are susceptible to control by proper arrangement and manipulation of the bord-and-pillar workings. The amount of pressure exerted upon the coal can be regulated by adjustment of the angle which the gob line G-G makes with the line of the working faces. This angle is regulated by adjustment of the step or lead from face to face, and of the length of the faces.

"The crushing of the coal can be regulated by adjustment of the gob line angle to change the pressure, and by adjustment of the angle between the gob line and the principal lines of cleavage in the coal to change the resistance offered. The tendency of the roof between the outstanding buttresses of coal to fracture and fall may be regulated by varying the distance which the buttresses project beyond the line C-C, which, in turn, is governed by the length and lead of the faces, or by the gob line angle. The gob line angle is an effective regulator of the various characteristics of the long-face or bord-and-pillar working and a study of its influence and functions will enable one to adapt this method of working to meet most conditions to which mechanical loading is to be applied.

Nature of the Pressure

"It is generally believed that the end thrust due to the horizontal pressure in the strata sustains in part the weight of the overlying strata, and in general it is only after the first major falls of roof strata into the gob have occurred that the full 'weight' or roof pressure is exerted upon the coal. Thereupon, the strata overhanging the coal face and extending back over the coal for some distance acts as a lever and as such exerts a pressure upon the coal which is manifest along the coal face and back over the coal for a certain rather definite distance. This pressure is greatest at the coal face and runs out to nothing at a certain distance back over the coal. It is this pressure which causes crush-

ing of the coal at the working faces, and it is this pressure whose amount may be varied by altering the gob line angle.

COMPONENTS OF THE PRESSURE

"The total pressure exerted by the overhanging strata at the working faces insofar as concerns its manifestation may be said to consist of three components, viz: (a) The pressure exerted upon the coal in process of removal at the working faces, called pressure component C; (b) the pressure exerted upon the timbering of the working faces, called pressure component T; (c) the pressure encountered in the maintenance of the heading leading to the working faces, called pressure component H.

"The intensity of the pressure in any particular case is indicated by the distance back from the gob line to which the crushing of the coal seam extends, and this distance, measured along a line perpendicular to the gob line, may be taken as a measure of the intensity of the pressure.

AREA OVER WHICH THE PRESSURE IS EXERTED

"The pressure manifests itself and the effects of the pressure must be dealt with over an area whose width is the perpendicular distance back from the gob line to which the crushing of the coal extends, and whose length is the length of the gob line. Hence, in a given panel of workings, where the width of the panel, the total length of working faces, and the capacity of output are equal, the area subject to the pressure and hence the total pressure exerted varies as the length of the gob line, and hence as the secant of gob line angle.

PRESSURE IS REGULATED BY THE ANGLE OF THE GOB LINE

"The amount of pressure and the manner of its distribution are largely governed by the angle (g) maintained between gob line and the face line. The term gob line does not refer to the absolute and somewhat crooked or irregular line of street demarcation between the gob and the coal faces, but rather to the straight line which marks the general trend, rather than the absolute course of the dividing line between the gob and the coal. (See Fig. 1.)

"The gob line angle (g) regulates the amount of pressure acting upon the coal faces in process of removal. It influences the amount of pressure thrown upon the working face timber and upon the extremities of the headings leading into the working faces. It affects not only the relative amounts of the respective components of pressure, but also the sum total of the components, and the degree of effectiveness of these components of pressure upon the breaking down or crushing of the coal and timbering.

"A knowledge of the influence of the gob line angle upon the various components of the pressure and their distribution enables us, to a considerable degree, to regulate them. A given variation of this angle does not result in a variation of all of the components of the pressure in the same way. Therefore, the practical problem usually becomes one of determining the influence of variations in the gob line angle upon each of the components of pressure, and then in deciding upon the value of the angle which will give the best combination of the various components of pressure.

THE PRESSURE COMPONENT (C) EXERTED UPON THE COAL AT THE WORKING FACES

Effectiveness of the Pressure Component C

"The pressure component C is effective insofar as it is able to break down or crush the coal upon which it acts. The effectiveness of this pressure component is inversely proportioned to the degree to which the coal resists crushing by the pressure. The ability of the coal to resist crushing by the pressure is a maximum or a minimum, respectively, according as the line of pressure intensity is parallel to, or at right angles to the direction of the principal lines of cleavage in the coal seam. The line of pressure intensity, being at right angles to the gob line, is determined by the direction of the gob line, and hence by the gob line angle (g).

"The total effect of the pressure, or the total disturbance, is influenced by the angle of the line of pressure intensity (e), which regulates the effectiveness of the pressure, as well as by the angle of the gob line (g), which regulates the area over which the pressure is exerted. But as the angle of the line of pressure intensity is governed by the gob line angle (g), the influence of the latter on the effectiveness to crush or disturb the coal, and hence on the fracturing of the roof, is twofold, and the influence of the gob line angle on the total disturbance may vary with the rapidity of a geometrical progression.

Amount of Pressure Desirable

"With respect to the pressure component C exerted upon the coal at the working faces, it is possible to get either too much or two little to insure the attainment of the best results. If entire dependence is to be placed in blasting as the means of breaking down the coal at the face, then the pressure on the coal should be as small as practicable. If it is desired to enlist the aid of the roof pressure in the breaking down of the coal at the face, then it is possible to get either too much or too little pressure to insure the attainment of the best results.

The Gob Line Regulates and Distributes the Pressure

"The gob line angle (g) regulates the total pressure, and the angle (e) of the line of pressure intensity regulates the effectiveness of the total pressure, but the gob line angle (g) is also a factor in the distribution of the components of the total pressure.

"Practical experience shows that, other things being equal, the pressure component C exerted upon the coal at the working faces is greater when the gob line angle (g) is greater. The influence of the gob line angle (g) in regulating the pressure component C exerted upon the coal arises from its influence upon the shape or proportions of the absolute course of the gob line, practically the same as the coal edge, in that according as the gob line angle (g) is more or less so will the absolute gob line be more or less of a zig-zag line.

Straight Gob Line Reduces the Pressure

"The absolute course of the gob line approaches a straight line as the gob line angle (g) approaches zero. The first effect of the straighter absolute gob line, due to smaller gob line angle (g), is that the fall of the roof strata is more rapidly and cleanly effected. It is a matter of practical observation that the 'cleanness' and rapidity of the break-off reach their maxima when the line of break-off is a straight line. The cleaner and more rapid the fall of the gob strata, the less is the amount of leverage possible to be exerted on the coal at the working face by overhanging strata which have failed to get cleanly broken off. Therefore, the leverage being less, owing to the end of the natural lever being less heavily weighted, the greater is the relief of pressure on the coal at the working faces. The pressure component C becomes less, or its maximum value is manifested for the minimum amount of time.

Influence of Absolute Course of Gob Line on Crushing of Coal at the Faces

"In true longwall work (i. e. with a bending roof action) we frequently get a value of the pressure component C on the coal faces which would be better if it were larger, while in bord-and-pillar work (i. e. with a caving roof action) this pressure is just as frequently a great deal larger than is either necessary or desirable—so much so, indeed, that the question of how to lessen its value becomes a serious problem in the economical working of the mine. There is more than one reason for this difference, but the chief reason is that in longwall work with a straight continuous line of face the gob line is a straight line. Therefore, by reason of the greater liability of the gob strata to break cleanly off at the straight line of face, there is greater chance of relieving the pressure on the face than where, as in all bord-and-pillar work the gob edge forms a composite angular zig-zag line.

"In a bord-and-piller working the stepped arrangement of the faces causes the outstanding corners of the pillars to stand in such a manner as to constitute in effect outstanding buttresses of coal which project into the gob. The roof pressure is exerted upon these buttresses of coal and they produce the same effects as do the buttresses of stone or packwalls built in the gob of true longwall systems of mining with the object of pitching forward the pressure onto the coal at the working face.

"In a true longwall system the effect of the stone pack is to transmit pressure to the coal. The stone pack in the gob acts as a resistance which is sufficient to prevent the strata from breaking off at the face, while on the other hand it is a resistance which is insufficient to prevent the strata from bending. It is this bending of the strata which creates the leverage by which the pressure, due to the weight of the back strata, is transmitted from the gob right into the coal face.

"In the case of either the bord-and-pillar or the longwall systems, we have a resisting buttress—a buttress whose resistance is very large but which falls short of the resistance of the solid coal beyond. The resistance of the buttress at the angular point extending into the gob is practically nil, and the resistance gradually increases as the sides of the buttress diverge from the angular points. Hence the crushing of the coal is greatest at the angular point and decreases as the resistance increases toward the solid coal.

"The length of the individual faces and the lead from face to face being con-

stant, all the angular points of the gob edge will lie along a straight line, such as C-C in Fig. 1, parallel to the gob line, and all the angular points of the coal edge will lie along another straight line, such as B-B in Fig. 1, also parallel to the gob line. The area between these parallel bounding lines is called the fracture zone. The weight or pressure exerted by the strata over the whole of the fracture zone contained between these parallel bounding lines is sustained solely by the triangular buttresses of coal whose aggregate area, under all circumstances, equals half the fracture zone.

"The parts of the pillars constituting the outstanding buttresses of coal resist the downward movement of the overhanging strata. The degree to which they do resist the movement controls the effects of the roof pressure. Between the two lines bounding the fracture zone the roof pressure exerted encounters a resistance which continually increases in amount as we proceed along a line perpendicular to the gob line from the points of the buttresses of coal, where there is only a small section of coal to remit the pressure, to the bases of the buttresses of coal, where there is the mamimum amount of coal to resist the pressure.

"As there is less resistance offered to the downward movement of the strata by the points of the buttresses of coal than by their bases, the roof strata will deflect or descend more in the region of the points of the buttresses of coal than in the region of their bases. The ratio of the deflection of the overlying strata to the distance or span over which the deflection takes place constitutes a measure of the stresses induced in the strata and of the consequent tendency to fracture.

"In bord-and-pillar mining the critical deflection of the overlying strata is that which occurs in the portion of the strata within the limits of the fracture zone wherein are located the projecting buttresses of coal. The relative amount of deflection of these strata constitute a measure of the stress and hence of the tendency to fracture. With a given roof pressure, it is evident that the wider the fracture zone, the less is the rate of downward deflection or the deflection per unit length, taken perpendicularly across the critical zone. It is also evident that the fracture zone is controlled by the length of the unit faces and the angle of the gob line.

"The downward deflection of the overlying strata induces a vertical stressing or beam action in the strata which tends to cause them to fail through tension in their upper layers.

"The strains induced in the overlying strata, and consequently the stresses and the tendency for the strata in the fracture zone to fracture and fall along the faces is found to be extremely sensitive to changes in the length of the faces and the angle of the gob line. In fact, taking a panel of workings with given face lengths and a given gob line angle; if the length of face be doubled, keeping the gob line angle the same, the strain in the overlying strata will be quartered; and if the gob line angle also be increased so that its line will be doubled, the strain will be quartered again; or the final value of the strain in the overlying strata will be one-sixteenth of the former value. Conversely, if the length of the face be halved. keeping the gob line angle the same, the strain in the overlying strata will be quadrupled; and if the gob line angle also be reduced so that its line will be halved, the strain will be quadrupled again; or the final value of the strain in the overlying strata will be 16 times the former value.

"These facts indicate the important influence of the gob line angle (g), and also of the length of the unit face or width of pillar. Both of these factors are of the first importance in bord-and-pillar or long-face work, because of the sensitive character of the relationship existing between them and the strain or displacement, and the consequent tendency of the strata overlying the fracture zone to fracture and fall on the working faces.

"Much depends upon the distribution of the stress, as well as upon its magnitude. With a given width of the fracture zone, the greater the strain, the greater is the rate of change of the stresses in the portion of the strata overlying the fracture zone, and hence the greater the tendency for it to fracture. With a given strain the less the width of the fracture zone, the greater is the rate of change of these stresses. The practical effect of the difference of stress is to accentuate the liability of the total stress to produce a higher degree of strain in the strata; and so, to a corresponding extent, accentuate the liability of the strata to break rather than to bend only. If the strata break or fracture, the result is to throw more load onto the projecting buttresses of coal and hence to cause more crushing of the coal at the working faces, and also to cause the strata in the fracture zone to fall on the working faces.

"The angle of the gob line and the length of the unit faces are the natural and effective means of regulating the pressure component C. An intimate acquaintance with the functions and influence of this angle will suggest a great number of means of adapting it to the conditions encountered.

The Pressure Component (T) Exerted Upon the Face Timbering

Influence of Gob Line Angle (g) on the Face Timbering

"The component of pressure (t) which is more particularly exerted upon the face timbering is to be carefully distinguished from the pressure component (C), described above. The working face timbering steps into the vacant space created by the removal of the coal, and, in one sense, this timbering is subjected to the pressure that was formerly exerted upon the coal whose former site the timber now occupies. But the face timbering does not in any sense step in and intercept the pressure component (C.)

"There is no timber, nor practically is there any substitute for such timber, that would for a single moment be capable of effectively resisting such an enormous pressure. As a matter of fact, the efficiency of the face timbering, or of any substitute for timber, depends upon its ability to yield to the pressure component (C) rather than upon any supposed ability to resist it. Its efficiency depends chiefly upon its elasticity. Whatever may be the value of the gob line angle (g), the pressure component (C) will always retain the potentiality of a power that no possible timber or timber substitute can effectively resist. The expression 'potentiality of a power' is used because in general the power of the pressure component (C), insofar as it affects the pressure on the timbering, will be chiefly potential, and only very slightly kinetic or active.

"The pressure component (C) is exerted upon the coal; it is resisted by the coal, but the resistance offered by the coal is not, in the absolute sense of the term, effectual. The coal offers a continual resistance to the pressure component (C), but the roof strata gradually descend in spite of the resistance offered by the coal.

"The pressure component (C) may, to a limited extent, influence the consumption of face timber, but the destruction of the face timbering by the pressure component (C) is a process requiring time. As the roof strata slowly descend, it first tightens the newly set timber, then drives it into the cap or bottom piece, then bends it, and finally breaks it. If the descent of the roof strata be comparatively slow, the face of coal may be entirely worked out and all the timber withdrawn therefrom before the pressure component (C) has destroyed a single timber. If the descent of the roof strata be more rapid, the timber, on a slow moving face, may have to be replaced as much as several times before the face is entirely worked out.

Effect of the Gradual Descent of the Roof Strata

"One result of the gradual descent of the roof strata within the fracture zone is that they gradually break up or fracture. Fragments become loosened or detached, and these, if unsupported by artificial means, will fall out. The sole object of the face timbering is to intercept the possible fall of such fragments. But the pressure component (C), except insofar as it may be relieved by the loosening of these fragments, is still, to the extent mentioned, sustained by the coal yet unworked. It is a common observation that after a face of coal is worked out, all the timber in the working place may, owing to the descent of the overlying strata, be driven into or even completely through the caps or bottom pieces; nevertheless, upon withdrawal of all the timber from the area the roof strata does not fall. In other cases every piece of timber in the working place may be broken by the pressure component (C), and still the roof will not fall, for the reason that the pressure (C) is sustained not upon the timber, but upon the coal yet unworked. The descent of the roof strata is not arrested by the timber; neither is its descent appreciably facilitated by the removal of such timber.

"The loading and destruction of the timber in the working places, so far as it is due to the pressure component (C), is governed not so much by the actual magnitude of this pressure as by the rate of descent of the strata which exert the pressure. Thus, the pressure component (T), insofar as it may be said to derive any portion of its value from the pressure component (C), is a pressure due to the velocity of descent of the roof strata rather than a pressure due to the magnitude of pressure component (C).

"The average stress on the resisting buttresses of coal is always practically the double of that on the coal beyond. The greater the area of the buttresses, the less likelihood there is of the strata fracturing, and hence the greater probability of the stress being partially transmitted to the solid strata over the solid coal. The greater the area of the buttresses, the more evenly distributed

are the strains in the overlying strata; the more pronounced is the bending strain as opposed to the breaking strain in the strata; and hence the velocity of descent of the strata of smaller magnitude. Thus the magnitude of the pressure component (C) is smaller as the shearing stresses in the strata are greater, and it is greater as the horizontal tension is transmitted over a larger area.

"The narrower the fracture zone and hence the smaller the pressure component (C), the greater the rate of change of the stresses in the strata. The smaller the pressure component (C), the more rapid is the break-up of the overlying strata into those fragments whose weight, coming as it does, solely upon the timber, is the very essence of the pressure component (T). When pressure component (C) is greatest, the least severe conditions are imposed on the face timbering, for in that case the velocity of descent is least, the timber is exposed to the pressure for the shortest possible period of time, and the less break-up there is of the overlying strata.

Rapid Break-Off at the Gob Line

"A large proportion of the effective pressure on the face timbering is due to a factor whose magnitude is necessarily in inverse proportion to the magnitude of the pressure component (C). That factor is the ability of the gob strata to break-off rapidly and cleanly at the gob line. With small gob line angles the pressure component (C) is comparatively small because the approximately straight absolute gob line, being comparatively free of projecting buttresses of coal, effectively facilitates the clean and rapid break-off of the gob strata, and so reduces the leverage exerted upon the coal.

Influence of Rapidity of Break-Off on Pressure Component (T)

"There are really two break lines to be taken into account in connection with pressure component (T). One is the gob line proper (line B-B in Fig. 1), at which the strata have already broken off; the other is a newer or embryo break line in process of formation. While the break line proper may be said to lie gobward of any given cut of coal whose working is still under way, there is in process of formation a new break line approximately along the solid face (i. e. along line C-C in Fig. 1). This, being parallel to, and in every respect the duplicate of the break line proper, must in the nature of things, possess the same general properties as those possessed by its parallel counterpart.

"Hence, in common with the break line proper, the embryo break line possesses the specific property of more or less effectively facilitating, according to its equal angle (g), the clean and rapid break-off of the overlying strata. The point to be noted is that on each working face under way, the face timbering occupies a position which lies practically between these two parallel break lines.

"When the magnitude of the gob line angle (g) is a minimum, then the total pressure and the pressure component (C) are also at their respective minima. For the gob proper has already broken cleanly off, and with the maximum of rapidity at the break line proper, and the leverage is a minimum. But in the same case, the working face under way, or that part from which the coal has been removed, becomes practically just so much newer gob. Within this area of the newer gob, i. e., within the fracture zone, is the site of the face timbering.

"The clean and rapid break-off of this newer gob at the newer break line in process of formation will be facilitated by the same factors which governed the previous break-off at the break line proper. The angle (g) being a minimum, the rapidity of the breaking off process will, in both cases, be a maximum. Therefore, the maximum weight of fragmentary strata will descend with the maximum rapidity. The rapidity of the breaking off process, which reduces the magnitude of the pressure component (C), influences the value of the pressure component (T) in the opposite direction. The head of the coal on the site of the face next to be worked is thus relieved of pressure with the greatest rapidity, but this relief of pressure on the coal next to be worked is effected wholly at the expense of the timbering along the working face yet underway.

"Pressure component (T) is chiefly due to the actually fractured (not merely bent) strata contained between the parallel break lines in the fracture zone and is synonymous with the aggregate weight of the fragments, more or less massive, which have become detached from the main body of the strata; for the weight of these fragments, if sustained at all, must be sustained wholly by the timbering. The aggregate weight of the fragmentary strata thus precipitated bodily upon the timber increases with a rapidity proportioned to the rapidity of the general break-off at the break line. Pressure component (T), if stated in pounds per square inch, may be very small as compared with pressure component (C), but its greater efficiency as a destroyer of the face timbering lies in the fact that its velocity of descent is limited only by the resistance of the timber.

THE PRESSURE COMPONENT (H) EXERTED UPON THE HEADINGS LEADING TO THE WORKING FACES

"The areas of the headings in a working subject to the pressure of the overhanging strata is proportional to the area over which this pressure is exerted, because the areas of headings constitute a fixed proportion of the panel area and because the only parts of the heading affected are those embraced within the area over which the pressure is exerted. As this area is proportional to the length of the gob line, the area of the headings subject to the pressure is proportional to the secant of the gob line angle; hence the smaller the gob line angle the less the area of headings to be maintained against the disturbance created by the pressure.

PROPER VALUE FOR THE GOB LINE ANGLE (G)

"No general answer that would apply to every particular case can be given to the question as to the proper value for the gob line angle (g). A knowledge of the influence of the gob line angle (g) will permit one to manipulate that angle in such a way as to cope with local conditions and to meet the particular necessities of the case. Within limits it is possible to obtain desired effects and to avoid others, but it will generally be found that the matter resolves itself into one of give and take.

"Apart from very shallow mines it is almost safe to say that the gob line angle (g) should be of the smallest possible magnitude. In mines of any considerable depth which are worked on the bord-and-pillar system, and under any practicable value, however small, of the gob line angle (g), it is usually found that the pressure component (C) is at least as great as is desired. It too often possesses a magnitude sufficient to crush the coal and cause the roof strata within the fracture zone to fracture and fall.

"One way of reducing the evil is to keep the gob line angle at the smallest practicable value. The practicable minimum is that value of the gob line angle (g) which is obtained when each face leads the face behind by the depth of one cut only. The disadvantage arising from the adoption of the minimum value of the gob line angle is that at that minimum angle the greatest value of the pressure component (T) is encountered.

"There is nothing new or novel in any of the facts presented above. Most of them appeared to be well known a quarter or half century ago when bord-and-pillar working was more generally practiced. They are again presented because of their applicability to the conditions arising with long-face mining."

***R. Y. WILLIAMS**, Consulting Engineer, Bethlehem, Pa.:*

"Mr. McAuliffe spoke of the case of a machine that was bought and when it reached the mines was found to be 6 inches taller than the bed of coal. I know of a very important and interesting installation of conveying and undercutting equipment that ran for about three years and during that time saved money. The management changed and that machinery is all scrapped today despite the fact that the people that operated it offered to take the contract on that mine and produce coal 25 cents a ton cheaper than had ever been produced by the room-and-pillar method. In my studies I am just as interested in the places that fail as those cases which succeed.

"I know one of Mr. McCullough's reasons for writing this paper. He wanted to try to get the operating men to think out the problem. Another reason was that in case the first attempts did not prove successful how the change of the angle and the change of the length of the face will tend to give you a change in result. As much as 90 percent of our mining today, over 90 percent is step face mining. Mr. McCullough's paper has almost universal application. Your slabbing operations are all in the last analysis step face mining and the studies which Mr. McCullough has made will be of vital help in giving you that angle and length of step. Now it just happens that I am on the other side of the fence in this matter of step face mining. In the step face you have this beam which Mr. McCullough described. You also have the lever hanging over which tends to break off of that beam. If you get the long face, as Mr. McCullough indicated, this beam action comes down to a point and you have eliminated the consideration of the beam provided you can put in something that will move the point of the application of stresses from the face out far enough to provide a place for your conveyor, a place for your undercutter, a place for your loading machine and a place for your men to work in safety."

ROOF CONTROL ON LONG FACES

E. F. WOODSON, General Supt., Crowe Coal Co., Henrietta, Okla.:

(This paper was read to the convention by W. T. Burgess, Republic Iron & Steel Co. The cuts mentioned in Mr. Woodson's article were unavailable when the proceedings went to press.)

"The introduction of loading machines, face conveyors and other methods of mining coal, which are designed to improve the quality of the coal and to reduce labor costs necessitate also a change in the plan of the working face. In coal veins of 5 feet and under in which conveyors and scrapers are used, it is more economical to plan an arrangement with a conveyor lying parallel to a longer face than the 16 to 40 feet which is about the average width of rooms in room and pillar systems of mining coal.

"If roof conditions and all other conditions are ideal for long wall system they could be used substituting the conveyors or scrapers in place of the mine cars. Where long wall methods are not deemed advisable, then possibly a short wall face system could be used.

"The company with which the writer is connected decided, in the summer of 1924, to try and reduce its labor cost and improve the quality of the coal produced.

"The conditions in the Henrietta Field where this experiment was tried are as follows: Coal 2 ft. 8 in. to 3 ft. 2 in. in thickness. The pitch of the coal is 1½ percent to the west. The coal is underlaid with fire clay, with hard silicious sand stone fossils embedded in it. This fire clay is six to eight inches thick, which is underlaid by a fine grained, thinly embedded sandy shale. The coal seam does not contain any water and that which accumulates in the mine comes from water veins above the coal at times when the overburden is broken to the surface. The roof is of a good quality of blue shale, with an overburden of two to three hundred feet, consisting of blue shale, sandy shale and close to the surface alternating with thin beds of thinly bedded fine grained sand stone. System of mining is the room and pillar plan. The coal is all undercut by short wall mining machines cutting in the coal. The rooms are 42 ft. wide. This entire field was strongly unionized.

"Long wall had been tried in the early days in this field under light cover and had not been considered a success, due to partial closing of the face at times. Later, the Victoria Coal Co. tried a long wall system and were reported to have been making a success, having passed the first and second roof breaks, but the company could not negotiate a scale of wages with the miners on a comparative basis with room and pillar work and were compelled to abandon the experiment.

"In the summer of 1924, the writer designed a sectionalized face conveyor, consisting of eighteen 10-foot intermediate sections, 1 tail section, 1 vertical curve section, and 1 combination drive and loading section. The coal was carried and dragged by 2 riveted chains connected by 1½ by 1½ by 16-inch angle irons every 18 inches apart, which chains ran in a trough of sheet iron, 24 inches wide at top, 22 inches wide at bottom and 4 inches deep. The return for the chains was underneath the trough, consisting of 2 angle irons placed 2 inches above the floor. The total heighth of the conveyor was 13 inches above the floor. The drive section and curve section conveyed the coal high enough to discharge into the mine car on the entry, which process eliminated bottom brushing. The sections were jointed together with a specially connected joint which would allow the conveyor to be shifted out of line 1½ degree in a vertical direction for each 10 feet of joint. Therefore, in three joints a change in alignment of 4½ degrees, either up or down, could be made.

"In planning a system of mining it was decided to establish a short wall face for the conveyor of about 200 feet in length, the conveyor face to be at right angles to the entry so that the conveyor would transport the coal from along this face and discharge it into a car on the entry. It was also decided to try and break the roof behind the break row of timbers, after each cut and not try and allow a gradual settlement of the roof as in longwall mining.

"With this mining method in mind and also careful that the members of the United Mine Workers of America did not know our plans for the future until after the conveyor arrived, we drove 4 rooms 16 feet wide up a distance of 150 feet. We then pulled the pillars, except the room stumps, next to the entry and installed the conveyor on the inside rib of the last room. We then started operations on the 150-foot face by undercutting with a short wall mining machine, using 6-foot cutter bar cutting in the clay. As we loaded out the cuts, we began pulling timbers in the first room, allowing this room to slab. We then pulled the timbers in room No. 2, and allowed this room to slab and kept on pulling the timbers, bringing our break closer to our break row timbers at the conveyor face. This break row of timbers consisted of 5 rows of approximately 4 x 4-in. timbers spaced about 18 inches apart, in the rows. The rows were about 12 inches apart. We gradually expanded our face to 200 feet and advanced the face approximately 150 feet with the conveyor when we began to get heavy roof breaks. These breaks evidently corresponded to the first breaks in longwall methods of mining. Preceding the time the heavy breaks occurred, the roof would slough off up to the break row timbers and stop. Sometimes this would cause a little pressure to ride the break row timbers and cause some loose rock over the conveyor, but this did not occur often. After the heavy breaks occurred, the action of the roof was different. Our plan was to cave the area back of the break row timbers, figuring that the roof strata would then rest on this caved area and solid coal ahead of the face, which would span the area at the face where mining operations were carried on. We reduced the number of break row timbers from five rows to three rows, so as to keep the conveyor and the three rows of timbers all within a 5½-foot space or the distance of the undercut. After the heavy breaks started, we would have a break with every cut of coal. The break was at the back of the undercut and formed an angle of 60 to 70 degrees with the horizontal and extending back over the caved area. The breaks would always follow at the back of the cut, as the mining machine crossed the face. After the mining machine crossed the face, the face conveyor was moved up 5½ feet or immediately adjacent to the face and the break row props were pulled and reset between the conveyor and the roof break, back of the conveyor. The section between the two breaks in the roof which the break row timbers had been holding was allowed to fall.

"We later encountered such heavy roof breaks that we could not economically extract the coal and had to abandon the experiment. The heavy roof pressure began at about the center of the face and continued to within 15 feet of the tight end (end of the conveyor face opposite the entry). This heavy pressure was caused by a normal fault; with approximately 1-inch throw pitching about 70 degrees with the horizontal and leaning back over the caved area. The line of this fault was nearly parallel to and close to the tight rib of the caved area and cut the overburden nearly all the way through to the surface. We were, therefore, removing all the coal from under this loose end of the strata. Later developments of room and pillar work proved that this fault was the beginning of a normal fault of approximately 3 feet displacement.

"During this experiment we studied the roof action very closely and formed some opinions which are given here. These opinions are given in the hope that they will bring out a discussion and cause engineers to study the theory of roof action over long faces more closely and finally solve the problems under given roof conditions.

"George S. Rice discussed the action of roof for longwall mining in volume 69 of the American Institute of Mining and Metallurgical Engineers proceedings on page 387.

"Line DE represents the line of draw. Area DEH is undisturbed roof overburden. Area DEFG is unstable overburden, while area GFKI has already settled. 'W' represents the direction of the force representing the weight of the overburden. 'A' represents the direction of the force due to the arch effect. The distance from E to F measured along the roof is greater than the distance from L to F, L being a point vertically below E. It is evident that cracks must be formed between E and F to make up the difference between these two distances and it seems probable that these cracks might be formed by tension forces. Each strata of rock in the roof being broken in the same manner as a cantilever beam of rock would break by being over loaded and breaking at the fixed end. Our experiment was with a face 200 feet long and we did not build any pack walls. We must now find how the roof strata will act and why it does act under the above conditions.

From results of the experiment above noted, we formulated the following theory as shown in Fig. 2. You will note that above line HK of Fig. 2 that Fig. 2 is a duplicate of Fig. 1. The difference lies below the line HK. The coal seam of Fig. 2 is shown by the area XYZU. The timbered area under the line YN. The breaks in the roof by lines LY and MN. The area LYMN is supported by timbers between line LY and the broken ground MNOK. The broken ground has formed a pack wall to support the overburden above the line EFK. The roof action is the same above this line EFK as it is in longwall mining. The breaks LY and MN which occur after each cut are shear breaks, ex-

tending over the broken ground at an angle of 60 to 70 degrees with the horizontal. The surface of the break is smooth to the touch and the breaks produce a powder as fine as flour. This powder can only be produced by the movement of strata under heavy pressure slipping along some break or joint in the strata. The direction of this break is evidently the direction of the resultant of two forces, one 'W' representing the weight of the overburden, acting vertically downward and the other 'A' possibly acting at some angle other than vertical in which case 'A' represents forces caused by the arch action. The force I have called 'A' could develop considerable pressure if we assume that we have a forward rolling movement of the roof strata between and above the point F and L. Force 'A' would exert its maximum pressure when stopped at the point 'L' by encountering solid strata above and overhanging the coal seam. The force 'S' represents the resultant of these two forces 'A' and 'W' and the direction of its action.

"During our experiment, we found that the shear break LY always followed the mining machine across the face at the back of the cut. That ordinarily the roof between Y and N dropped from ⅛ to ¼ of an inch. That the timbers between Y and N did not show but slight pressure; that the roof between Y and N seldom showed any cross breaks of any nature; that after the cut of coal PRYZ was loaded out that one prop for each 8 feet of face was about all the timbers that were required until the break row timbers from under section YN were removed. When break row timbers under YN were removed the pressure would increase on the timbers between R and Y. The roof strata LYMN would fall after the timbers were removed from under it.

"The lack of pressure on the timbers between R and Y while the cut was being removed proves that the weight of the overburden was not carried on the props which were set between R and Y. It could not have been carried by the strata HLYX as a cantilever beam, as the shear break at R had already occurred. The strata MNOK was all broken material and the surface MN of the broken ground could not carry this weight by friction, as a crack of a small part of an inch existed there. The weight of the overburden over this section RY must then be carried by an arch extending from 'S,' the line of draw LD to the settled broken MNOK.

"I know that strata MNOK was broken but I do not know how high this broken material extended in our experiment, but at least 25 feet. Sound engineering judgment would teach us to try and make the height of this broken ground well above the height of the vein. If it were possible to figure the overburden as a plastic material of known nature, we would figure the total pressure 'S' was the same as if acting at a point one-third of the cover above line HK. If we could control this pressure, we would want this total pressure 'S' to act on the coal seam several cuts ahead of the conveyor face.

"To produce the best breaks, we would want to use props set tight in the break rows. We would want to set props in place of cribs and always remove all timbers from under the sections we were caving. We should have at least 2 feet of clear space between the gob and the roof under sections we were caving, so that the upper limit of the broken strata would be well above the roof of the coal vein.

"If the roof is breaking properly a shear break will follow the advancing face along the rib on each side of the caved area. In our experiment we drove a gob entry with the gob on the opposite side of the entry from caved area and the only trouble we experienced was a little extra brushing of loose material over the entry so as to keep the entry safe for the passage of men and mules. Our experiment did not prove a financial success due to the above mentioned fault. Even though we were extracting the coal from this loose end of this overburden caused by this fault, we never lost a section of the conveyor and we never had our face closed, although, on the last two cuts the sections of roof strata on the inside half of the conveyor face would settle about 6 inches and mushroomed our break row timbers. We gained sufficient knowledge of our roof conditions to know that this caving system of mining would be successful in an area where no faults existed.

"We have not attempted to open up another conveyor face due to our opening up the mines on the 1917 wage scale and not yet having our working forces sufficiently well organized to make the attempt."

Discussion:

DR. YOUNG:

The discussion of this paper was assigned to W. D. Brennan, General Manager of the Phelps Dodge Corp., Dawson, N. Mex., but Mr. Brennan cannot be present and Geo. B. Pryde will take his place.

MR. PRYDE:

"During the past year and a half, prior to the installation of conveyors or scraper loaders, we have been experimenting with long face retreat mining. I use the words long faces, as compared with our room and pillar advance work where we have our rooms only 20 feet wide and retreat with pillars 25 and 30 feet in thickness. Our long faces are varied in length from 150 to 450 feet, depending somewhat on the thickness of the coal seam. Our coal seam varies considerably in thickness, being in some parts of some of the mines as low as 4½ feet, while in others we have 9 feet of coal.

"The mines of the Phelps Dodge Corp., at Dawson, N. Mex., are located in the upper cretaceous formation and the seams are practically level. The openings are all drift openings going into the hills, which rise rapidly from the valley in which the tipples are located. This results in the cover above the coal gaining very rapidly so that in many parts of our mines we have from 1,500 to 2,000 feet of over burden.

"The rock formation in the upper cretaceous are sand rocks of a rather fragile character with large interlying strata of sandy shale. There is practically no water in any of the formation above the coal so that the breaks are the result of the removal of the underlying supports. As I have already mentioned, the formation being fragile, the breaks are on the most part free and occur at frequent intervals when the underlying supports are properly removed.

"It is rather hard to believe that where 4½ to 5 feet of coal is removed that some times these breaks go to the surface, although the cover at such points is sometimes fully 1,500 feet. This is probably caused by the fact that the rocks are of such character that they continue to break when the underlying support is removed rather than having the tendency to arch.

"Our experience, where we attempt to remove the continuous face with a seam more than 6½ feet in thickness has been rather disastrous. We have been able to open up faces and retreat for a distance of 75 to 100 feet in this particular character of coal, but after the supporting timbers have been removed for the second or third time we have found that the roof has a tendency to ride over the props and break off at the face of the coal support.

"However, where our coal is below 6½ feet in thickness we have had very good success in handling our roof and breaking it off systematically with our break line of props, which are usually from 12 to 15 feet from the face of the coal. Our practice is to set our props at about 2-ft. intervals in each direction and remove two sets of props, at the same time two additional sets are placed along the coal face. At all times we are very insistent that all props be removed from the gob and that the entire coal be taken out so it is possible for the roof to break freely and all come down, not having any supporting pillars in the gob.

"The conclusion of our experiments to date is that if all the supports are taken out as the long face advances or retreats, whichever the method of mining used is, that all support has to be removed and that the closer the supports can be kept to the coal, thus bringing the break as close to the coal face as possible, the better the results will be. To date, we have never felt it safe to have less than four rows of props to protect the machinery and men working along the coal face.

"We feel that the time element as to the rapidity with which these faces are advanced or retreated, is of vast importance, but to date have not had an opportunity or experience enough to reach any conclusion as to what time element is proper here with us. We feel that the tensile strength of the overlying strata will govern this to a large extent, and as ours varies considerably, it is going to be very difficult for us to reach a definite conclusion. My opinion is that conditions may be such that rather than have a short face and retreat rapidly, it will be found that a longer face with a slower retreat will work out better. Such a condition might give the overlying strata time to settle.

"The caving of roof or of control of this caving, with us, is quite closely associated with the ventilation. We find that the places where the strata overlying the coal are composed of shale, that the effect of the air on this is of very great importance. It is our endeavor, at all times, not only to remove obnoxious gases, but to keep a current of fresh air moving along the face and, of course, a portion of this travels over the gob and comes in contact with the roof and overlying strata. This, we find, helps materially in keeping the roof on the move. As it is our practice to keep water for sprinkling purposes at all places, we also use this water to keep the roof wet back in the gob. The effect of water on the shale is to cause it to disintegrate quite rapidly."

DR. RUTLEDGE:

"I am going to refer to Mr. Woodson's paper especially because for 10 years I had the great good fortune to represent the United States Bureau of Mines in the southwest, looking after Indian mines which are mined by operators who operate on a lift. They pay 8 cents per ton royalty. The net average from a McAllister seam is about $300 per acre. Mr. Woodson has done a very noteworthy piece of work. He has aided in increasing the royalty for these Indians from $500 to $600. When you get his paper and have the opportunity to read it I think you will find some things in his theories of very great value.

"I don't know when I have heard a subject in its very ramifications opened up as well as Mr. McCullough did in that first paper. The point of view of bringing the support on the points of those pillars is rather new in this country."

MR. ENZIAN:

"Mr. Ramsay, do you consider the packed walls a rigid support?"

MR. RAMSAY:

"No. The packed wall in Illinois after a year or two is only about half of its first thickness. It is crushed down. If it were yielding it wouldn't throw the weight on its face. I advocate the rigid support in panel long wall, and the trouble is that they haven't yet thrown it back on the gob. The greatest advance that has been made lately is leaving the open space and saving the timber."

DR. YOUNG:

"For the benefit of most of us whose experience has been in long wall mining we ought to have a whole day to get the long wall men with us so that we may discuss some of the fundamentals which they have learned in the many many years which they have been placing with these tremendous weights. One of the real problems we have in developing narrow panels in modified long walls 200 and 300 feet is that we cannot discover for some time, years perhaps, just how our own strata are going to act, while with these great cantilevers we get in the long wall, we know that certain fundamental principles will be carried out from the start."

CONTROL OF ROOF IN THE EAGLE SEAM

***JOSIAH KEELY**, President Cabin Creek Cons. Coal Co., Kayford, W. Va.:*

DIFFICULTIES OF ROOF CONTROL OF THE EAGLE SEAM

"The No. 1 Gas, or the Big Eagle seam of Southern West Virginia is a high grade by-product coal which approaches the New River coals both in appearance and in its geological position. It can usually be sold where the No. 2 gas, which is just above it, just misses the market. It is not nearly so regular in its distribution as the No. 2 and is exceedingly tricky as an investment. Probably no other gas coal of this section is more eagerly sought after nor opened with more misgivings. As a performer it is like the little girl with the little curl.

"Where the No. 2 gas carries fairly uniform height and grades, the No. 1 gas coal, which is older and should know better, is as capricious as April. To the best of my knowledge there has never been a dust explosion in the No. 2 seam but in the Eagle, where two or three particles of dust are gathered together there is a potential explosion, and the main reason why there are not more recorded catastrophies is that for every particle of dust there are several little drops of water handy. Then, if there is any virtue in rock-dust, you can not go very far in the Eagle seam before you have handled enough rock to make a fairly uniform distribution of rock-dust and mud, both of which are recommended for safety.

"When the Eagle was formed carbonaceous matter was plentiful but extravagantly used. The main seam was decorated with all kinds of little trimmings, above and below, with soft bluish shales in between. There are upper and lower markers, a Little Eagle and several War Eagles. The fact that quite frequently these seams will congregate to make a valuable seam is one thing which makes it so romantic and gives it such an appeal to the coal gambler. Also, the miner, in an entry where the coal and the water and the slate is split three ways, knows the slate will never be any less, but there is always a chance that the coal will get thicker or thinner and that his entry will turn up hill. However, I have heard miners claim that water will run up hill in the Eagle seam.

"I have been asked to say a few words on roof control in this seam. Those of us who extract coal usually think of roof control under two headings: (1) The control of the draw slate, which must be taken down or held up, and (2) the handling of the main top when extracting pillars. Also, there is a second draw slate and there is the problem of so spacing the rooms and barrier-pillars that there will be no movement of the main over-burden while the first withdrawal of room coal is going on. Aside from the soft nature of Eagle coal and the fact that it usually has a few score feet more of over-burden than the No. 2 seam, I have never discovered much difference in the manner the main top acts under the process of initial extraction. In both seams pillar drawing is attended with cracking clear to the tops of the mountains and letting in surface water on the splint seams where it is held by a bottom fire-clay instead of coming immediately into the lower mine as one would expect. In both No. 1 and No. 2 seams we drive rooms on 60 foot centers and leave 200 foot barriers with 100 foot barriers on the panels. There can be no rule for this unless you happen to know what is under the few feet of hard bottom. In some places a variation of 5 feet has caused the bottom to heave, and in other places the coal-hogs of early days left 7 foot pillars which are still standing, but not worth going after.

"Some 30 years ago a rule of thumb was advanced by 'scientific men' that you could count on over-burden arching itself in 10 feet for every foot of coal thickness so that in extracting a 6-foot seam there would be little disturbance 60 feet above. I believe even to this day there is a good deal of argument about the effect on overlying seams of the withdrawing of the lower seam, but in the land of the Eagle coal we expect a break to appear sooner or later on the mountain tops as much as 1,000 feet up. In fact, I was asked to pay for a cow which had fallen into one of these cracks and failed to come through.

"I presume, really, that the main problem to which I should devote these brief remarks is the draw slate problem. That is, that part of the roof which we should control by taking down or holding up during the process of initial extraction.

"I do not believe I would be warranted in being dogmatic about any mining problem, much less the roof of the Eagle seam, but this is what usually happens when you set posts: Everything between the post comes down and leaves a column of fast crumbling shale crowding the useless posts. In one case I recall a determined superintendent who set up regular bents every 8 feet with headers about the size of railroad switch ties. The last time I heard from this timbering the draw-slate had come for three or four feet and was still falling between the timbers. In this case, obviously the only thing that might have been done that was not done was to lag between the bents, but we can not afford to construct an entire wooden top to our mines even in West Virginia, although in this mine there was 7 feet of almost absolutely clean Eagle coal.

"The decorative seams some 5 or 6 feet above the Eagle seems to be the objective of all this slate movement. In places where this little marker is within 2 feet of the coal I believe it would pay to take the top to this point to start with rather than use timber and incur risk to the miner.

"It is a popular belief that the rapid deterioration of this roof is a 'gassy' condition. That is, that in the ages past certain inert gases were caught in the pores of the slate and held under enormous pressure until the removal of the coal gave a chance for expansion. Considering the soft character of the roof it is hardly necessary to conjur up any difficult reason for its breaking down. We all know that soft bottom comes up from pressure above pressing the pillars down into the bottom. When the roof is of the same constituency as soft bottom there is much more reason why it comes down by the weight of the over-burden.

"There is really no such thing as roof control under these circumstances, at least not in the sense we use that term. It is just a matter of calculation as to whether the coal is worth what it will take to get it, and this we do not know until we have tried. Enough timber will hold it. Enough brushing will get rid of it. Those who claim it is a 'gassy' condition advise keeping the air-course ahead and letting the slate come, believing it will relieve the entry, but I doubt if this has ever been proven conclusively. Taking the slate down and putting it in specially cut gob holes might cheapen the process of slating as compared with hauling it outside, but nothing will compare with a locally trained foreman skilled in this particular seam and familiar with every device for fighting it. More often than not he can tell you just what slate you might be able to hold and what will have to come down. It narrows down to a day to day fight."

***CARL SCHOLZ**, Raleigh-Wyoming Coal Co., Charleston, W. Va.:*

"We have tried to control the roof, but we don't understand how to do it. We haven't been able to do very much, but I know this much. Some 30 years ago I bought a coal mine which was abandoned because the roof was bad. The rooms were 18 feet wide and I changed

them to 80 feet wide. We had better success in holding up a roof 80 feet wide than the 18 feet—that is an actual fact. Roof control is one of the very essential things. To my notion the best system is the modified system of long wall working. I have been working for the last two or three years in this direction. We have been laying off our workings for the last 10 years perhaps on a basis of getting 60 to 80 feet faces, believing that method would enable us to do two or three things. We believe that prepared sizes are more in demand than smaller sizes, and in this belief we have been meeting with success. All of our coal will be gained from 80 to 100 feet faces, but we have not been working it long enough to know what the result will be. Our present idea is building small cribs 30 inches square, buried in slack. By undermining the slack we will be able to remove the cribs without using any powder to blast the cribbings out of place. We don't know how this is going to work."

RECENT DEVELOPMENTS IN ROOF CONTROL

WM. C. STRATTON, *Chief Engineer, U. S. Coal & Coke Co., Gary, W. Va.:*

"Roof control enters largely into the consideration of many of the most important problems of mining. For example: Before ground is broken for initial construction, there must be a decision as to size of car used in transportation. The size of car determines, within narrow limits, the width of pit mouths or size of shafts and width of headings.

"In determining the width of headings many factors must be considered, but roof control must not be lost sight of. In the same way this question of roof control enters into many other problems that fundamentally affect the success or failure of the undertaking.

"Roof control refers to the general planning and operation of the mining so that in the complete extraction of the coal bed, the least possible danger and expense is incurred in connection with the support and the subsidence of the overlying strata.

"In this discussion the term 'Roof Control' will be used in the sense of supporting the strata immediately over the coal in the active working place.

"From the early days of mining roof has been controlled by the use of wood, in the shape of posts, and posts and collars. The use of wood resulted from the fact that it was adaptable to the work, easy to shape to length and size, plentiful, easily obtained, easily handled (low specific gravity), and cheap.

"The disadvantage of wood for this purpose lay in its comparatively short life and its lack of strength and permanence as compared with steel and masonry.

"Masonry, in the form of arches, was early used in securing passageways that were to have a long life, as shaft bottoms and main haulage roads. Later steel was employed for the same purpose.

"Masonry adapted itself to points where long life was assured, but was not adaptable to the actual working face, since it could not be removed and reused.

"Attention to the subject of roof control has existed since mining was first undertaken, but special attention has been given to this subject in late years, due to the increasing scarcity and cost of timber and the increasing cost of labor.

"In setting timber there are, of course, two items of cost, material and labor, the latter often lost sight of.

"The timber mine prop is an instrument of roof control, the first employed and at present the one most universally used. It has its advantages and disadvantages, but any other instrument of roof control must compete with the timber mine prop.

"There have been designed and patented many steel mine props in the effort to obtain a prop more easily set and cheaper in that, although more expensive in first cost, repeated uses ultimately reduce the cost.

"In the 1922 transactions of the Institute of Mining Engineers of Great Britain, Vol. LXIII, Part 4, in an article by Mr. John Roberts, there are described and illustrated some 26 types of steel props. This list does not attempt to consider props designed in this country.

"In all these devices the object is the same—to reduce the material and labor cost of roof control.

"In the last two or three years the United States Coal & Coke Co. has employed two O'Toole cutting and loading machines in the extraction of room ribs by open end method.

"In connection with this work, roof control has an important part. At first wood posts were employed, but the withdrawal and the setting of timber required too much time and cost too much money. As a substitute for the wood posts, hydraulic jacks were used. These, of course, in the last analysis were only steel posts or props, but they accomplished the object of reducing the material and labor cost of roof control. Many times more expensive in first cost, long life made them lower in material cost, and the advancing of them was lower in labor cost. At the same time, they increased safety to men.

"In an effort to still further reduce the cost of roof control, various types of collapsible timber cribs were employed. These were of two main varieties which we know as one-way and two-way cribs. The one-way consists of a crib 2 feet wide by 4 feet long of a height to suit the coal, constructed in two sections, each section composed of framed timber and the sections joining near the center on a sliding plane 45 degrees with the horizontal movement on this plane extending or lowering the jack, with the movement controlled by a screw or a chain wrapping around a crank operated shaft.

"The two-way crib has a base or bottom section the same as the one way, except that there are two equal sliding planes at 45 degrees with the horizontal and 90 degrees with each other. The top section is in two parts, separated by a plane vertically over the junction of the inclined planes in the lower section. By bringing the two halves of the upper section together or allowing them to separate, extends or decreases the height of the crib. Movement of the two upper halves is controlled as in the one-way jack.

"This two-way jack is particularly successful. Since it has been employed only behind the O'Toole machine it is being advanced mechanically by power from that machine. It has also proven particularly reliable at times of heavy roof movements.

"From what we have done up to this time, we are led to believe that ultimate safety and economy will be obtained by a roof-control instrument, sufficiently rugged in construction that it will be capable of use over a comparatively long period, and will be designed for advance by mechanical power."

Discussion:

MR. THOS. H. CLAGETT, *Bluefields, W. Va.:*

"After experimenting with hydraulic jacks and steel props with a view of reducing the cost of timbering, Mr. Stratton refers to collapsible wooden cribs as having been very successful, from which it may be inferred that this is rather necessary to proper roof control, but it is generally conceded that timber for mine purposes is becoming scarer and more costly."

MR. GLENN A. KNOX, *Gunn-Quealy Coal Co.:*

"We are using conveyors in our mine approximately 250 feet long, and we are breaking our roof every 15 feet or every second cut with a maximum distance from the working face of 15 feet, and we are controlling the roof with rigid timbers, and while we use cribs we only use them as safety for the men and machinery, and we find that we handle our roof much better by collecting the timbers, setting them uniform in strength and using a minimum thickness in order to hold the roof rigid and not allow it to give in any way. If the roof starts to give, there is nothing that we can do to hold it.

"We have a conveyor that we installed right against the face before shooting. It is a heavy type Link Belt conveyor, and we place it directly against the face as we shoot the coal. The coal is about 6 feet 3 inches in thickness. The roof is a rather strong sandy shale. We have worked continuous face of about 2,000 feet in length, and we have worked out two blocks of approximately 250 feet at a time. We have now worked out an area of 500 feet in width and 2,000 feet in length. We tried various schemes and methods, but met with no success until we adopted the scheme of breaking the roof just as close to the working seam as possible. If we can't break our roof every 15 feet, we cease to produce coal until it is broken and down."

"*Q.* What size timbering? *A.* About 8 or 10 inches in diameter. *Q.* What is the cost of extraction compared with the room and pillar method? *A.* Slightly less. We haven't encountered a great saving. However, we think that we eventually are going to show a saving. In this block of 500 feet in width and 2,000 feet in length it shows more than 100 percent extraction. *Q.* Do you want to get lump coal? *A.* We are commercial operators and we want screened sizes. *Q.* What is the nature of your roof? *A.* It is hard and sandy. *Q.* Do you ever use any explosives? *A.* Never. *Q.* How do you draw those props? *A.* By digging them out underneath. *Q.* Is the coal clean? *A.* Yes. *Q.* Pretty hard? *A.* Pretty hard. *Q.* In the operation of getting your coal on your conveyor into the mine car you don't save much money? *A.* Not a great deal. *Q.* Do you undercut it or shoot it down? *A.* We undercut it. *Q.* What is the difference between your face and your breaking row? *A.* The breaking row is about 2 feet from the conveyor and 4 feet from the face, or about 10 or 11 inches from the back of the cut. *Q.* I suppose you do less shooting here than in the rooms and does the weight help you some? *A.* Yes. *Q.* Have you ever lost a face for any length of time? *A.* Not on (*Continued on page* 599)

METALS

PRACTICAL OPERATING MEN'S DEPARTMENT

GUY N. BJORGE, Editor

Practical Operating Problems of the Metal Mining Industry

MINING METHODS IN THE BUTTE DISTRICT

Evolution Of Butte District From Gold To Copper Producer—Three Methods Of Stoping Employed—Drilling By Wet Stopers—Ventilation Tubing And Auxiliary Electric Fans Used On Advance Work—Powder Magazines Gunited

By H. J. RAHILLY*

THE Butte Mining District is situated in Silver Bow County in the southwestern part of Montana.

Butte originated as a placer mining camp, gold being first discovered in 1864. Some few years later, the prominent quartz veins traceable on the hill sides were located and subsequently these veins were mined for gold and silver, treatment being effected first in arastres and later in stamp mills. After the "outcrops" of these veins which were oxidized or leached had been mined, it was learned that the veins below contained copper bearing minerals and Butte gradually became a copper mining district.

GEOLOGY

Granite forms the principal country rock of the Butte veins, aplite and rhyolite in the form of dikes and sills are common in the extreme western part of the district, and quartz porphyry dikes occur in the central part of the copper producing area. The ores occur in fissure veins, which have been divided roughly into three principal systems locally known as east-west or Anaconda, Blue and Steward Systems.

The Anaconda vein system varies greatly in strike, changing from a slightly northeast direction to a southeast direction. The dip is generally to the south.

The Blue vein system has a northwest southeast strike and southwest dip and is closely related to the Anaconda system.

The Steward veins have a general northeast strike and south dip, and are later than the other two vein systems.

All these veins are complicated by splits and faults, with displacements in some instances up to several hundred feet.

The principal copper minerals are chalcocite, bornite and enargite with some amount of chalcopyrite, tennantite and covellite. The ore occurs in an altered granite gangue associated with varying amounts of pyrite.

MINE OPENINGS

Mining operations are carried on through vertical shafts sunk in the country rock, their depth varying from 800 to 3,600 feet. The size of shafts vary somewhat, but the standard shaft is 7′ x 21′ outside and consists of four compartments, two of which are used for hoisting ore, an auxiliary hoisting compartment for men and supplies and a fourth for air, water, drainage lines and electric cables. Compressed air first motion or direct connected electric hoisting engines are used.

UNDERGROUND METHODS OF MINING

The general method of development consists in opening up levels at intervals of 100 or 200 feet by crosscutting from the shaft to the vein, and then drifting on the vein. Raises are then put through from one level to the other for ventilation and to be used later for transferring of supplies down into the stopes, when stoping operations have started.

There are in general three methods of stoping employed in the Butte Mines, namely, the square set, rill and stull. Each of them are modified at times to meet conditions.

The square set is used extensively and is employed:

1. Where the vein is extremely wide.
2. Where there are one or more bands or slabs of ore which require careful sorting or separate blasting to keep the ore clean.
3. Where the vein, although narrow, is soft and the walls not hard enough for the use of stulls.

In the latter case if the vein has a dip of about 60 degrees the regular square set timber is often modified to simply a cap and a hanging wall post. Figure 6.

The rill method is employed best in a vein of medium width 3 feet to 10 feet, having good walls, and where the vein

* Assistant General Superintendent, Anaconda Copper Mining Co., Butte, Mont.

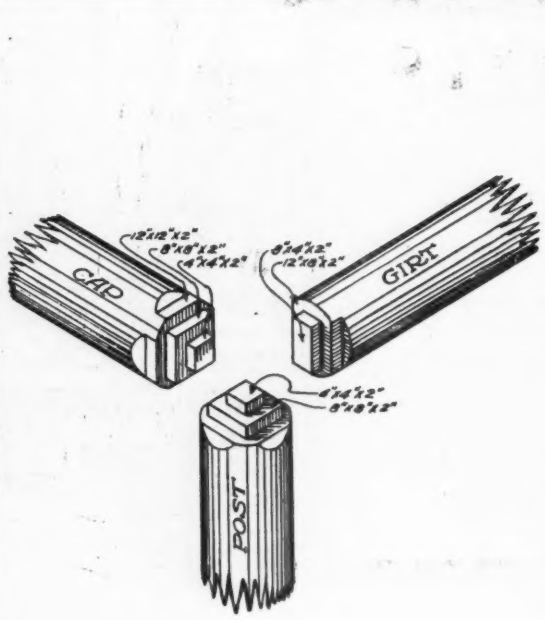


Figure 1

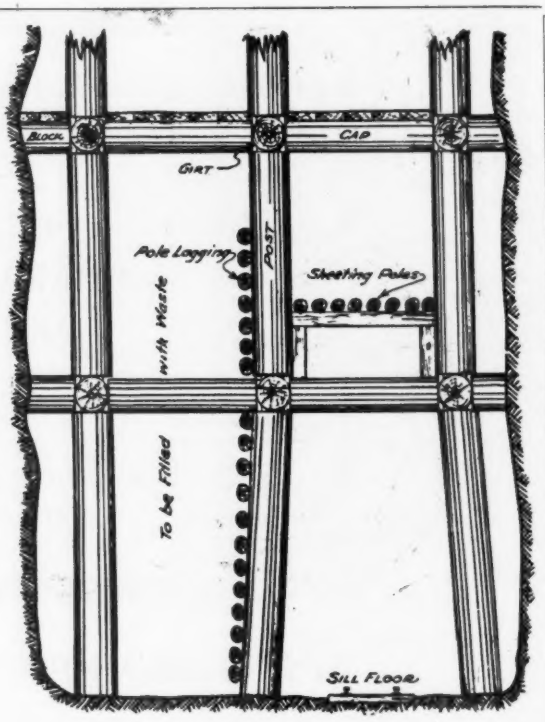


Figure 2

itself stands up well and the ore is clean, necessitating little sorting.

The stull method is used in flat veins which have good walls, but are irregular in width and require sorting.

In the square set method of stoping, raises are driven at intervals of 50 or 100 feet along the strike of the vein, these consisting of a manway and either one or two chutes. Between these raises a chute and manway is carried up with the stope every 25 feet.

Practically all the mines in Butte use a standard square set frame as shown in figure 1, which is 5′ 4″ center to center each way and a 7′ 5″ post.

After the first two floors are mined out, sheeting caps and sheeting is put in over the sill set and waste dumped in as filling. If raises are put up at an interval of 50 feet instead of every 100 feet, most of the waste filling can be slid into the stope with little or no handling, but when the raises are 100 feet apart a car is used to distribute the waste. Waste filling is obtained as the result of sorting and from the development work.

A stope is filled within about two floors of the back. The top or miners' floor and the one below it or muckers' floor are left open, and enough space below this to take care of the waste which is sorted out, the ore being shoveled into the chute. See figure 2.

In the rill method of stoping, raises consisting of two chutes and a manway are driven 20 to 25 sets apart. Two chutes and a manway between are carried up midway between the raises. The first floor is generally timbered with square set timber and the rill formed above this floor, the ore being first shoveled through stop boards until the rill is long enough to extend to the chute. In a rill stope the ore should be fairly clean and require little sorting. Occasionally to take care of a small amount of sorting, square sets are placed on each side of the chute at the bottom of the rill, thereby forming a flat sorting floor in the rill so that the waste can be picked out of the ore and dropped into the square sets below. See figure 3.

The stull method of stoping is used largely in Butte on narrow veins and in flat veins. The chutes are put in about 25 feet apart and after the stope is up a short way "wings" consisting of gob lagging are extended up from the chute in a funnel shape. This allows the waste to be sorted out and put back of these wings and the ore goes into the chute. From time to time the chute is raised, as are the wings, thus providing more gob room. See figure 4.

The back filling stope is occasionally used where the vein is hard and tight and the walls good. Chutes are carried up much the same as in a square set stope either with regular square set timber or with cribbing. The equivalent of two or three floors are mined between filling operations, only sufficient broken ore being drawn from the chute so that the miners can drill from on top the muck pile. All the ore is then withdrawn and filling introduced. See figure 5.

A timbered rill is as the name implies a rill stope in which timber is used to support the walls, the back being worked the same as in a regular rill.

Two men work ordinarily in every stope each shift, one drilling and the other mucking. The two men on each shift or a total of four work on the same contract, are paid a cubic foot price for breaking, timbering and shoveling, and the contracts are measured and paid once each week.

Water and air at suitable pressures are piped to each stope and drilling is accomplished by wet stopers of the following type and make: Ingersoll-Rand CCW-11, CCW-21; Waugh No. 76 self rotator; Sullivan DT-421 and DT-44. One-inch quarter octagon steel in four changes is used in all stoping machines.

For drifting and crosscutting Ingersoll-Rand No. 248, N-70, Sullivan DW-64, Waugh Turbro No. 21, Chicago Pneumatic No. 5 leyner drifters are used. Either 1¼″ hollow round or 1″ quarter octagon steel is used for drifting. The rounds are generally drilled from a column with two or three settings of the arm and a 12 to 16 hole round is used. Where the N-70 and CP-5 are used the drill is set on a cross-bar and one man drills while the other man mucks. The standard drift timber is

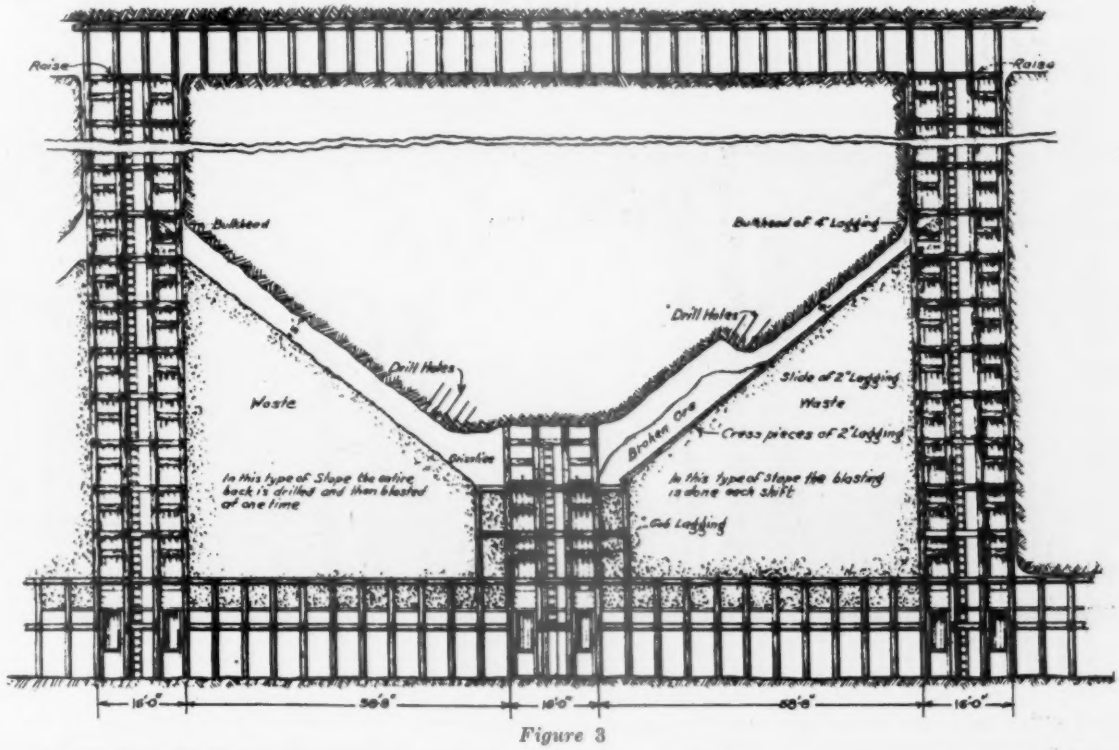


Figure 3

5' 4" center to center each way requiring an excavation about 7' 6" x 9' 6". Round timber is used almost exclusively.

Small crosscuts for prospect work are often driven requiring about a 10 hole round. If the ground is good they are not timbered, or in any event only light timber sets are put in.

In drifts, crosscuts and raises where necessary electric driven fans and ventilation tubing is used to supply a good quality of air. The tubing is made up in 25 foot lengths and the diameter varies from 12" to 24" depending upon the quantity of air required.

On an ordinary level 4" air and 3" water lines extend from the shaft through the principal drifts. From these main lines branch lines of 1" or 2" size are run to each working place.

A 5½ ton electric motor either of the trolley or storage battery type, with a train of 10 to 15 cars, having an 18" gauge and a capacity of 13 cubic feet per car, is used to haul the ore from the chutes to the skip pockets on the various stations.

The skip pockets have a capacity of about 200 carloads of broken ore. The ore is run directly from the pocket into the skips through doors operated by air lifts. The skips are 4 to 5 ton capacity and are operated in counterbalance.

The powder is delivered to the mine twice a week and is sent underground and trammed by hand to the various magazines, one at least of which is on each working level. Powder cars pro-

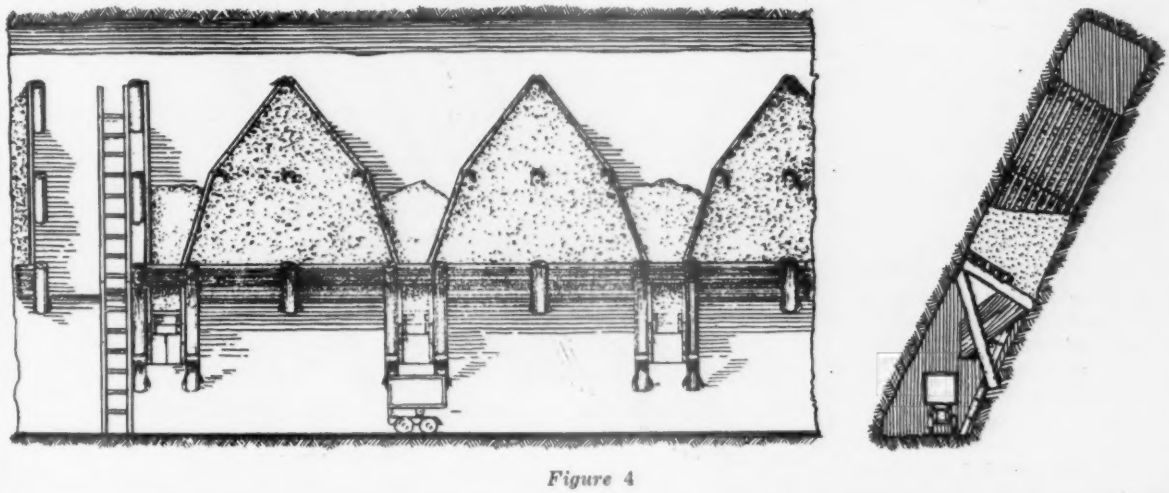


Figure 4

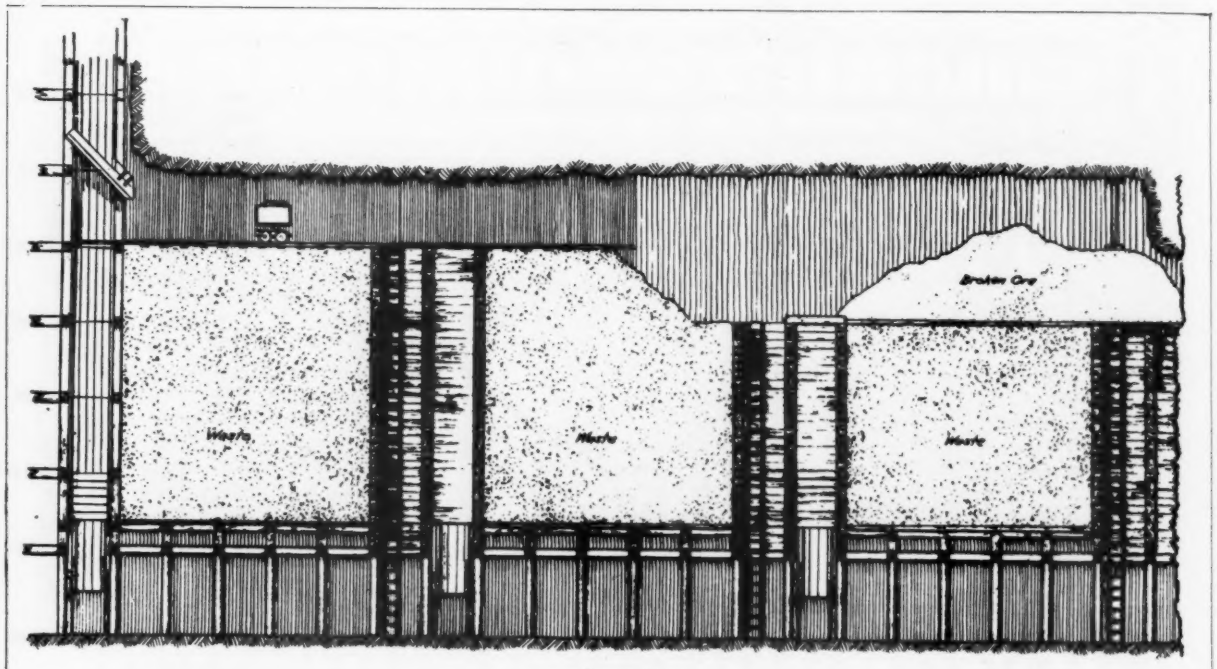


Figure 5

vided with a wood lining and tight cover and holding 16 boxes of powder are used for transportation underground. DuPont special 1⅛"-35 percent is the powder that is being made a standard.

The miners generally make up their own primers underground at the fuse magazines. A No. 8 blasting cap and Lion, Comet or Dreadnought brand fuse is used.

All fuse and powder mazazines are placed either in rock crosscuts where there is no timber or else in a timbered place that has been gunited and made fireproof. Electric lights are installed and no open lights are allowed in the magazines.

Electric blasting is used in shaft sinking and in wet drifts or crosscuts. Various delay fuses are employed and the blast is fired from a 115 volt alternating current circuit.

The total quantity and value of asbestos mined in the United States and sold in 1925, as reported by producers to the Bureau of Mines, amounted to 1,258 short tons, valued at $51,700. These figures comprise 93 tons of chrysotile asbestos, valued at $40,750, mined in Arizona and California, and 1,165 tons of amphibole asbestos, valued at $10,950, mined in Georgia, Idaho, and Maryland.

Imports of unmanufactured asbestos for consumption, amounted to 230,520 short tons, valued at $7,134,302, and the exports were 1,109 short tons, valued at $70,846.

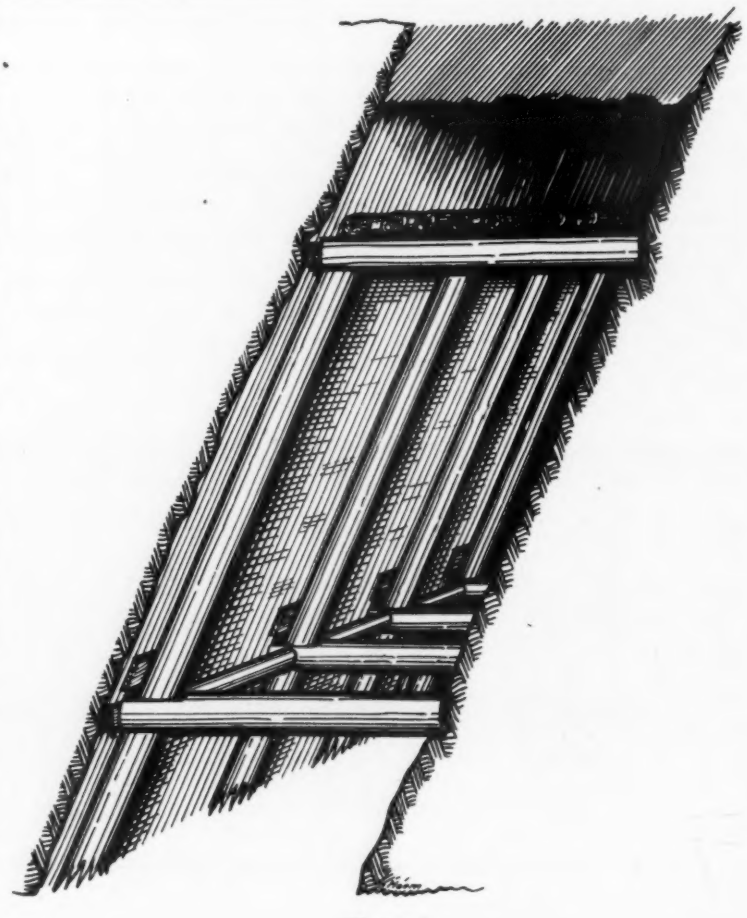


Figure 6

MINING METHODS AT PORTLAND MINE

The Portland Mine Is Worked Through Four Vertical Shafts, Three Of Which Are Electrified—Pumping Equipment Handles Approximately One Thousand Gallons Per Minute—Entire Cost To Deliver Screenings To Mill Less Than One Dollar Per Net Ton

By J. W. Ady, Jr.*

THE Portland Mine, in the Cripple Creek District of Colorado, has been in active production since 1892. During that period it has made a gross production in excess of $55,000,000 and has paid dividends in the amount of $11,812,080.

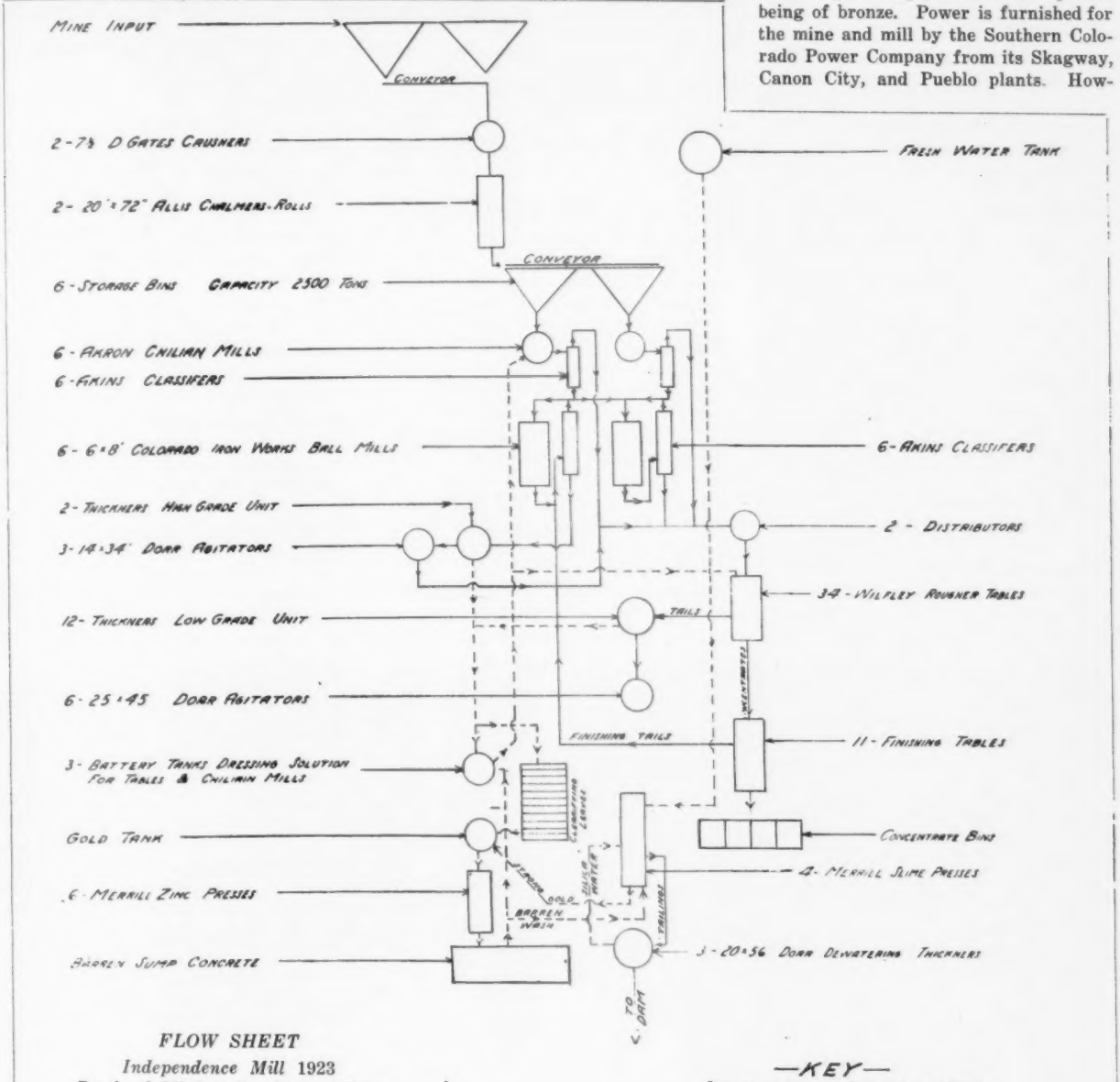
Dividends were discontinued during a period from 1920 until they were re-established on an 8 percent basis during the present year.

The property is worked through four shafts, all vertical and all of which are electrified with the exception of the Portland No. 2 shaft. Air is furnished from a central plant at No. 2 which is equipped with Ingersoll-Rand electric compressors with a steam compressor plant as a standby.

All pumping is done through the No. 2 shaft, where approximately 1,000 gallons of water are raised per minute from the 3,000 foot level to the 2,100 foot level, from which it flows out five miles to the portal of the Roosevelt Tunnel.

All pumping is done by Lecourtenay Centrifugal Pumps, bowls and impellers being of bronze. Power is furnished for the mine and mill by the Southern Colorado Power Company from its Skagway, Canon City, and Pueblo plants. How-

*Managing Director, Portland Gold Mining Co., Colorado Springs, Colorado.


MINE INPUT
CONVEYOR
2 - 7½ O GATES CRUSHERS
2 - 20" x 72" ALLIS CHALMERS ROLLS
6 - STORAGE BINS CAPACITY 2500 TONS
CONVEYOR
6 - AARON CHILIAN MILLS
6 - AKINS CLASSIFERS
6 - 6'x8' COLORADO IRON WORKS BALL MILLS
2 - THICKNERS HIGH GRADE UNIT
3 - 14'x34' DORR AGITATORS
12 - THICKNERS LOW GRADE UNIT
6 - 25'x45' DORR AGITATORS
3 - BATTERY TANKS DRESSING SOLUTION FOR TABLES & CHILIAN MILLS
GOLD TANK
6 - MERRILL ZINC PRESSES
BARREN SUMP CONCRETE
FRESH WATER TANK
6 - AKINS CLASSIFERS
2 - DISTRIBUTORS
34 - WILFLEY ROUGHER TABLES
TAILS
AMALGAMATORS
FINISHING TAILS
11 - FINISHING TABLES
CONCENTRATE BINS
4 - MERRILL SLIME PRESSES
3 - 20'x56' DORR DEWATERING THICKNERS
TO DAM
—KEY—
DOTTED LINES = SOLUTION & WATER
SOLID LINES = PULP

FLOW SHEET
Independence Mill 1923
Portland Mining Co., Victor, Colo.

ever, a turbine is installed at No. 2 to supply power in an emergency. All lower levels are also provided with bulkheads and steel doors as an additional safeguard.

As was customary in the Cripple Creek District, the Portland, prior to 1924, hand sorted all of its ore. In that year, however, at the suggestion of Fred Jones, Mine Superintendent, the Portland abandoned its former practice and substituted at the No. 2 and Independence shafts, Grizzlies 45 feet in length which were provided with heavy bumpers. By means of this operation a separation is made at the No. 2 shaft into screenings which will ship from $50 up and a coarse reject which will generally average only one-tenth the value of shipping ore. This plan has resulted in a large saving to the company and eliminated many difficulties attendant on the old method.

The Independence shaft is used only to hoist mill dirt from the 700-foot level. This mill dirt is produced by caving the areas in the Independence and Portland where the wall rock between the network of veins, long ago stoped out, has been found to be commercially mineralized.

The 700-foot Independence haulageway connects with the 900-foot level of the Portland and is equipped with electric haulage and 4¼-ton self-dumping cars. Air controlled chutes facilitate loading. There are eight of these chutes drawing on the caved areas above. The loaded cars are dumped on 10-inch Grizzlies, over size being sledged through to the pocket below. Here, again, air-controlled chutes are used to load the skips which raise three tons each. Hoisting is effected here by a converted steam hoist driven by a 350 H. P. General Electric motor. A maximum speed of 1,000 feet per minute is attained so that a skip is dumped every 70 seconds. On this hoist, as is also the case at No. 2 shaft, flat cables are used. All mill dirt hoist at the Independence passes over Grizzlies 45 feet in length made of railroad rails set approximately 2 inches apart and provided with bumpers which break and jar off the quartzy portions of the coarse rock. The screenings from this operation are lowered from chutes into the mill train, operating in the adit level and go directly to the mill bins. The reject, which comprises approximately 75 percent of the total rock hoisted, is removed to the dump by electric haulage.

This shaft is operated now only two days a week, as a great volume of the mill dirt is coming from other shafts. The operation is an inexpensive one as is evidenced by the fact that we cave, transport and hoist this ore, dispose of the reject and deliver the screenings into the mill bins at a cost of less than $1.00 per net ton.

Independence Shaft Portland No. 1 Shaft Portland No. 2 Shaft Independence Mill in Foreground

The No. 1 shaft is 1,400 feet deep and equipped with an electric hoist, using round ropes. All operations here are carried on by lessors operating for the most part on a split check basis. All reject from the lessors sorting is dropped into a raise connecting with the adit level and treated in the mill.

The principal tonnage from the mine is produced from the No. 2 shaft from the 2,700, 2,900 and 3,000 foot levels.

Down to a depth of 2,450 feet practically all of the ore was produced from a vein system paralleling the granite-breccia contact. At this point cross fissuring became more marked and on the 3,000-foot level the values have practically left the contact vein and are all found in a new series of cross veins in the breccia.

These cross veins, which were first encountered on the 2,600-foot level, are showing mineralization at greater distances from the contact on each level as we go down, the vein known as the North No. 1 east vein being mineralized for a distance of 540 feet from the contact on the 3,000 foot level. The values in this vein system are evidently controlled by a phonolyte dyke which by its dip intersects the fissures and produces highly enriched ore at these intersections. The areas between 2,900 and a point above 2,750 produced a large amount of high grade ore. The richest of this is being sorted out underground, sacked and reduced to a bullion in the mill.

All ore from the bottom levels is drawn from filled stopes and hoisted to the ore house and then passed over grizzlies as above described. The screenings from the enriched area are shipped to the Golden Cycle Mill at Colorado City where they are roasted and cyanided. The reject, together with screenings from mill dirt stopes, is dropped into a raise which is connected with the adit level, drawn into 4¼-ton self-dumping cars of the mill train and hauled directly to the mill bins. Electric haulage is used in the adit level and a train of 10 cars is drawn by a trolley motor car.

The Last Dollar shaft is 1,400 feet deep and equipped with electric hoists and compressors. The operation there is almost entirely by lessors operating on a split check basis. The production amounts on the average to about 1,000 tons of shipping ore per month produced on company account and ranging in values from $50 up to in excess of $100 per ton. The lessors generally produce about the same tonnage although the grade is only about 25 percent of the value of the company ore.

Approximately 16,000 tons of mill dirt ranging in value from $4 to $7 per ton is treated monthly at the mill. The Independence Mill, owned by the company, formerly treated approximately 1,000 tons daily, but since it has been in charge of the present superintendent, John M. Tippett, the tonnage has been considerably reduced and a much higher extraction made. During the past three years there has been a steady improcement in the operation of the mill and at the present time extraction is approximately 90 percent, and this without roasting. In the mill the ore is drawn from the storage bins and fed to gyratory crushers, through rolls and is then elevated to the bedding bins, from which it is fed to the Chilian Mills. Classification is followed by further grinding in ball mills. The ore is then concentrated on Wilfley tables, the concentrates being shipped to the Golden Cycle Mills in Colorado City for roasting and cyanidation. The (*Continued on page* 605)

COAL

PRACTICAL OPERATING MEN'S DEPARTMENT

NEWELL G. ALFORD, Editor

Practical Operating Problems of the Coal Mining Industry

THE RELATION OF DISCIPLINE TO UNDERGROUND SAFETY

Underlying All Movements For The Prevention Of Accidents Must Be Discipline If Any Success Is To Be Obtained—Absolute Fairness To Workers, Plus Rigid Enforcement Of Rules Essential

By W. Z. PRICE*
U. S. Bureau of Mines Photographs

SO MUCH has been written and taught both by example and precept on the subject of safety that it is extremely difficult to find anything new and interesting on this most vital subject.

Systematic control is another way of expressing discipline and a most apt one for application to industrial safety. If control of the worker is lost by the foreman it is impossible to develop altruistic ideas like safety in the men. I use the word altruistic advisedly because to most individuals it is that. To say that you must not touch this or that because of some possible danger that might materialize is very vague and unreal in the minds of many.

Men are but grown-up children and children only learn by experience the vital matters of everyday life, industrially speaking, of course.

Thousands of men regard bulletin boards as places where plant news may be broadcast or where notice of a raise in wages is occasionally posted. Do they go to be educated by safety posters exhibited there? Not many. Departmental rivalry in accident prevention is found placarded on many such boards and men go to see them and see how they stand in this most desirable competition but any feeling engendered by this is not due to safety bulletins. This is not meant to decry this valuable literature; it has its definite place in our great industrial scheme but underlying all movements for accident prevention must be discipline if any success is to be attained.

In mining, I can speak for no other industry, organization is paramount. Numerous mines almost "run themselves" because of the splendid body of

* Assistant Supt., The Buckeye Coal Co., Nemacolin, Pa.

Miner taking down draw-slate with a 5-ft. bar, thus eliminating danger of falling slate. Safe Practice.

A careless miner standing up in a moving trip. No electric cap lamp. Dangerous Practice.

Trolley wire across room neck unguarded. Rails lie along rib. Dangerous Practice.

Trolley wire guard erected. No loose material about. Safe Practice.

men comprising their official groups. This is the first stage in systematic control, the control of the executives from the foreman to the manager. They are welded together by mutual respect and the knowledge that success for one is success for all. Whether we call the head of the group the manager or the general superintendent and the other extreme the foreman or the fire-boss is a matter of words only. Each must be in a sense an official and have a feeling of responsibility in his work.

Monthly safety meetings should not be employed to embrace too cumbersome a body of men if any real effect is to be attained.

Rather, let the general superintendent, his assistant and the department heads set aside one day each month wherein they review the accidents of the past month and decide on any feasible plans for preventing them in the future.

Not only accidents but general safety measures can be discussed, such as installation of automatic mine signal switches, fire fighting equipment, headlights for mining machines, special oil cans for certain pieces of equipment, mine fan interruptions, elimination of oil waste at mine pumps, etc.

This small unit of six or seven men is the nucleus of that systematic control which means so much.

From this meeting goes the mine foreman who naturally has charge of the underground safety and calls a meeting of his subordinates, the assistant foreman, fire bosses, transportation bosses, machine boss and in fact all men in the mine who have the care and supervision of others. To these men, the mine foreman outlines the main issues that were discussed by the central committee that affect underground work and instills in them a zeal for the execution of such practical safety measures as may have been decided upon.

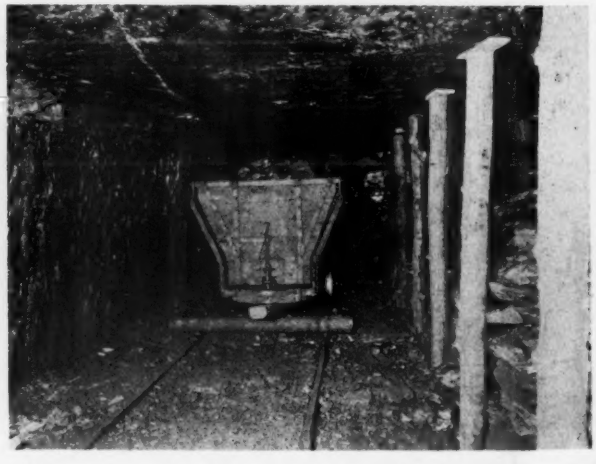
Each of these men is dependent upon the mine foreman for his "bread and butter" and each is cognizant of the fact that if accidents occur due to his negligence after being instructed, he may be suspended or even discharged. Here is discipline again and of the most rigid kind.

In turn these men go to the miner at the face, the motorman, the timberman, etc., and talk to them "straight from the shoulder" along the same lines, promising the same sort of reprisal in case of trouble as was promised them and, what is most important, they see that this is fulfilled to the letter.

There we have the key to the situation. No threats, for threats get nowhere, but quick decisive action immediately upon discovering any violations of company rules or standards as well as the mine law.

There must be, however, absolute fairness in disciplining an employe. To fail in this will set all good efforts a decided step backward. If men learn and they soon will under right conditions, that they will be strictly disciplined for (*Continued on page* 605)

The result of wearing loose clothing. Jacket catches in brake and miner is dragged along haulage way. Dangerous Practice



When cars are blocked properly in pitch rooms they cannot move and accidents from this source are eliminated. Safe Practice.

Fig. 1. Six blasting equipments approved by the U. S. Bureau of Mines

SAFETY AND ECONOMY IN HANDLING EXPLOSIVES

Bureau Of Mines Recommends That Coal Be Mined Exclusively With Permissible Explosives, Fired Electrically, And That As An Aid To Blasting, All Coal Which It Is Feasible To Cut Should Be Cut Or Sheared

By J. E. TIFFANY[1]

MORE than 200 million pounds of explosives are sold annually for use in the coal mines of the United States. These explosives are inherently dangerous to handle and constitute a hazard from the time they are received at the mine until they are fired in the shothole and often after they are fired. All coal companies should have rules for the handling and use of explosives. These rules will depend somewhat on local conditions, but in order to promote safety they must be rigidly enforced. To show what can be done by careful regulation, the Bureau of Explosives of the American Railway Association, reported that during 1925 the railroads of the United States and Canada transported 500 million pounds of all classes of explosives without a single fatality. Three general classes of explosives are used in coal mines in about the following proportions: Black blasting powder, 62 percent; permissible explosives, 22 percent; and high explosives, 16 percent.

EXCLUSIVE USE OF PERMISSIBLE EXPLOSIVES

Permissible explosives should be used exclusively for blasting in coal mines because they have been tested under prescribed conditions by the United States Bureau of Mines. These tests establish the safety of permissible explosives when fired in the presence of explosive mixtures of air with coal dust or gas or both. On the other hand, black blasting powder and high explosives will not pass the tests required for permissible explosives, and for this reason they should not be used in coal mines. There should not appear to be any necessity for the use of high explosives in coal mines because it is possible to select a brand of permissible explosive suited to any class of work.

HAZARDS OF BLACK BLASTING POWDER IN COAL MINES

There are hazards in using black blasting powder that are not present to the same extent when permissible explosives or even high explosives are used. Black blasting powder is dangerous because of the ease with which it can be ignited by flame and sparks and the dangers that attend the handling of the metal keg in which the powder is commonly packed.

The dangerous practice of making, with a pick or bar, a hole in the end of the keg near the chime, has led to many accidents with attendant fatalities. Even when opened in this manner with wooden tools, three accidents that resulted in 18 fatalities are reported by Howell.[2]

A keg of black blasting powder can be exploded by allowing the flame of a miner's open light to remain in contact with the keg for 2 or 3 minutes. This may have been the cause of the accident in the Baltimore tunnel on June 5, 1919, where 143 men were being transported underground in a trip containing 24 kegs of black blasting powder. In this accident 92 men were killed and 44 injured. This "accident in the Baltimore tunnel would probably never have occurred if the Pennsylvania anthracite code had contained a rule," which would not have allowed anyone except the train crew or powdermen to ride on a train carrying explosives,[3] and the kegs had been transported in an insulated box or car.

The dangers attending the handling of explosives make it advisable to confine, to as few persons as possible, the operations involved in storing and distributing; charging the boreholes, and firing the shots.

In some mines the miners carry out many of these operations themselves. The employment of shotfirers tends toward greater safety and places the carrying out of the work in fewer hands. Reliable men should be especially detailed for the purpose of transporting and delivering explosives underground. Probably the safest way is to have the blasting operations handled and the holes charged by the foreman, section foreman, or designated shot-firers. Although in general it is inadvisable, explosives should not be stored underground at coal mines, an exception can be made under these conditions, where it may be necessary temporarily to store the explosives. This storage should be in suitable magazines made in the solid coal or rock at least 300 feet distant from any shaft or main slope, or 50 feet

* Published with approval of the Director, U. S. Bureau of Mines.

[1] Explosives testing engineer, Pittsburgh, Experiment Station, U. S. Bureau of Mines.

[2] Howell, S. P. The menace of opening kegs of black blasting powder with wooden tools; Reports of Investigation, Serial No. 2161. Bureau of Mines, 1920, 3 pp.

[3] Ilsley, L. C. The transportation of explosives in and around mines. Reports of Investigation, Serial No. 2528, Bureau of Mines, 1923, 8 pp.

from any traveling way or intake airway, and should be provided with a strong door, kept securely locked. Not more than 200 pounds of explosives should be placed in any one magazine and all other explosives should be kept in the surface magazines. All magazines should be under the charge of a competent person or persons and kept securely locked except when those in charge are on duty at their respective magazines. The handling of explosives to and from magazines will be discussed under the heading of transportation.

Surface Magazines

When building a new magazine its size, location, and materials of construction will have to be decided upon.

The topography of the country can in many cases be taken into consideration in choosing a magazine site. Advantage should be taken of hills, so that where present they may be used as natural barricades. Proper drainage is essential. Apart from these considerations the magazine site should meet the requirements of local and state laws or regulations. The distances of the magazines from inhabited buildings and public railroads and highways should not be less than those prescribed in the American Table of Distances.[4] Separate magazines should be provided for high explosives (including permissible explosives), black blasting powder, and electric detonators. Sufficient explosives for one day's use may be stored on the surface in auxiliary or distributing magazines which should be located not less than 200 feet from any mine opening, building or inhabited dwelling.

All magazines should be barricaded by either natural or artificial barriers.

Types of Magazines Recommended

Complete plans and specifications of surface magazines and barricades can be procured from the Institute Makers of Explosives. Three of the types recommended by the Institute are suitable for storing permissible explosives or similar high explosives. The plans show methods of construction, which are designed to offer reasonable protection against bullets, weather, and fire.

Type A is constructed of medium soft brick laid in cement mortar or containing from 15 to 25 percent lime, with roof bullet-proofed with a sand filling. Type B has a weak cement mortar filling between the wooden inner and outer linings with the outside of the magazine fireproofed with not less than 26 gage black or galvanized iron. Type C is one of the standard types of portable steel magazines, bullet-proofed with weak cement mortar, or with 4 inches of brick laid in cement mortar or lined with sufficient wood.

For the storage of black blasting powder Type F is recommended. This type is constructed with the outside sheathed with ⅞-inch lumber and fireproofed as in type B. The studding must be not less than 2 by 4 inches. The inside of the magazine should be lined with 1 by 6 inch lining strips which should be secured to the studding and spaced about 6 inches apart. Type A, B, C, or F is suitable for the storage of detonators and electric detonators. All magazines should be properly ventilated.

The size of the magazine depends upon the quantity of explosives that will have to be stored. In localities where deliveries can be made promptly on short notice, a capacity of 2,000 pounds is adequate. In isolated regions, a large capacity mine may require a magazine of a capacity between 20,000 and 40,000 pounds. A magazine in which 40,000 pounds of explosives is to be stored should have outside dimensions of at least 14 by 19 feet and 8 feet high under the eaves—a common height for magazines. Such a magazine when barricaded and located in accordance with the American Table of Distances should be at least 1,340 feet from the nearest inhabited building, 805 feet from a public railroad and 400 from a public highway. These distances can be reduced one-half for a maganize in which only 2,000 pounds are stored.

Unbarricaded magazines must be located at twice the distance that barricaded magazines are located from inhabited dwellings and other improvements.

Storage of and Opening Explosives Containers

Those in charge of a magazine should see that the oldest explosives are issued first. This is usually accomplished by arranging the storage of the boxes, so that the older explosive is in the front part of the magazine. For ventilation purposes, in addition to the devices provided in the construction of magazines, the boxes should be stored so that a space of a few inches is left between the walls and the boxes. The boxes should also be placed so that the cartridges of explosive are stored horizontally and not on their ends. This is to guard against the leakage of nitroglycerine from the cartridges. Boxes of explosives should be opened with a hardwood wedge and hardwood mallet, outside the magazine, at a distance from it, and in a place protected from rain and direct sunlight. The use of metal tools such as nail pullers, hammers, hatchets, or chisels should not be allowed. No lights, other than permissible electric cap or hand lamps, should be used in magazines.

The floors of magazines should be regularly swept and kept clean. If the woodwork becomes stained with nitroglycerine it should be scrubbed with a solution of ½ gallon of water, ½ gallon of wood alcohol, and 2 pounds of sodium sulphide. A stiff broom, hard brush, or mop should be used, with plenty of the liquid so as to decompose the nitroglycerine thoroughly.

The ground within at least 60 feet of magazines should be kept clear of combustible materials, such as leaves, dry grass, stumps, and debris, as a precaution against fire.

When magazines are being repaired all explosives should be removed to a safe distance, and all nitroglycerine stains removed, by the means described above, before any repairs are made.

Transportation of Explosives

Between the years 1906 and 1922, Ilsley[5] reports 7 accidents and disasters as occurring while transporting explosives. Black blasting powder was involved in all of these accidents of which at least four were caused by electricity and the remainder were due either to the carrying of an open light or to an employe smoking while transporting the explosive. It is also worthy of note that three of the electric accidents occurred outside the mine. In one case "400 kegs of black blasting powder had been loaded into 4 mine cars at the railroad, to be hauled to the magazine, up grade, by a trolley locomotive. On starting the motorman put sand on the rail and a grounded circuit passed through the hitchings and so exploded the powder. No insulation was used between the locomotive and cars." The other two accidents were both very similar to this one.

Insulated Cars or Boxes

Transportation hazards in and around the mines can be best guarded against by using a specially constructed insulated car or box. Figure 2 shows a box used by The Davis Coal & Coke Co. Such containers for transporting explosives should be efficiently insulated by lining the inside with thoroughly seasoned wood, over which sheet asbestos is placed. Another lining of wood covers the asbestos. The wooden linings should be secured by wooden pegs and wedges. There should be no metal parts such as bolts or nails exposed inside the body. Electric detonators and explosives should not be transported together except in separated compartments as shown in the second view. This box has two compartments and can be placed on one of the regular mine cars. The one compartment, for electric detonators, is divided into sections and each miner's cap box, which contains the number of electric

[4] Hall, Clarence and Howell, S. P. Magazines and Thaw Houses for Explosives, Tech. Paper 18, Bureau of Mines, 1912, p. 12.

[5] Ilsley, L. C. The transportation of explosives in and around mines. Reports of Investigation, Serial No. 2528, Bureau of Mines, 1923. 8 pp.

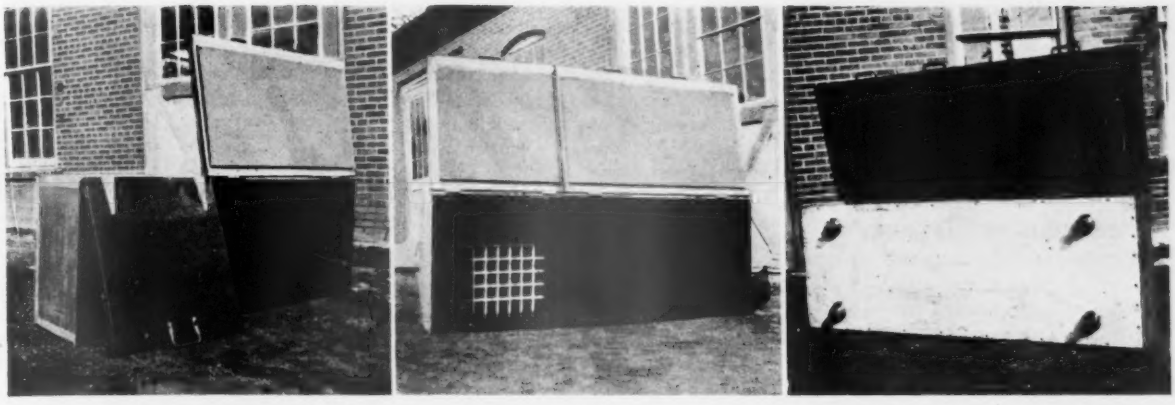


Fig. 2. Insulated explosives box used by Davis Coal Co. The first picture shows a full view of box. Note handle to raise the lid over detonator compartment. Two handles on the other lid. Composition of brattice cloth on the lid to turn water. Second view with both lids open. Note rubber matting on lids which fit snugly when closed. Third view shows bottom of box with large porcelain insulators.

detonators for the day's work, is separated from the other by wooden lattice work. The electric detonators contained in these cap boxes are separated from each other by being placed in holes drilled in a wooden block. The box in its entirety was built of 1½ inch lumber, lined with a layer of asbestos and covered with a ½-inch wood lining. In addition, the lids were covered with rubber, ¼-inch thick. The box rests upon four large porcelain insulators.

Men and Supplies Must Not Ride With Explosives

In transporting explosives men should not be allowed to ride on any cage, skip, bucket or car, on which explosives are carried, except such employes as are necessary to oversee the handling of the explosives and these employes must not smoke while engaged in this work. Tools, timber, and other materials must not be carried in the same car as the explosives.

The Illinois law requires the electric current to be turned off on roadways through which the explosive is transported and the work to be done during the interval after the shot firers have come out of the mine and prior to the entry of the day shift into the mine in the morning; but in the interim before such powder is delivered to the men, it shall be kept in a closed receptacle.

In Iowa the explosive can be hauled electrically only after the coal miners and other employes have ceased their work and have departed from the mines. The transportation and delivery of explosives underground is to be carried out by men employed for that purpose. This law does not protect the men thus employed because no provision is made for electrically insulating the explosives containers.

Several States have laws which forbid the placing of explosives on electric locomotives. Such a law should be rigidly enforced and where no such law exists one should be so enacted. The rigid enforcement of this rule will be a safeguard against many possible accidents.

The laws of many States permit the men to carry their individual supply of explosives into the mine when walking or when riding on a man-trip, providing the explosives and electric detonators are being carried in separate electrically non-conducting containers. This practice should be avoided as much as possible by limiting the transportation and distribution of explosives by men who are employed for the purpose.

How Miners Should Carry Explosives

Where the miners carry their own explosives and shot-firers are employed, then the shot-firers can carry the electric detonators contained in electrically insulated containers. The container for carrying the miner's supply of explosive should not be larger than that necessary for one day's supply and should be made of an electrically non-conducting material such as wood, fiber, or canvas. Figure 3 shows miners carrying their one day's supply of explosive in a heavy canvas sack. At some mines the miners are furnished with numbered checks, one of which they give to the shot-firer for each electric detonator used. At the end of the day the shot-firer turns in a check for each detonator fired during the shift. The unused detonators and the checks are delivered to the detonator distributing magazines.

Fig. 3. Miners carrying their one day's supply of explosive in a heavy canvas sack.

All explosives should be apportioned into the individual containers at the distributing magazine on the surface. The containers should be stored underground in portable, tightly locked wooden boxes, each having a lid which laps over the sides of the box and is strongly hinged. Battens should be placed over all cracks so that the explosive may be protected from sparks, flame, and water. Fuse and cartridge paper may be stored with explosives. No detonating or blasting caps and no tools or pieces of metal, matches, or oily material should be allowed in the powder or explosives box. The powder box should be placed in a cross-cut or recess, which should be at least 60 feet from the working face and so situated that there will be no danger of the box being struck by flying pieces of coal or rock or from ignition by blown-out shots.

It is the custom of some miners to cache their explosives and detonators under flat pieces of slate in the gob, but this is dangerous practice and should be forbidden. Also, explosives and detonators should not be left promiscuously on the floor near a rib because cases have been reported where explosions of gas and coal dust have been started by roof falling on explosives so placed. The miners, when permitted to charge their drill-holes, should carry their electric

detonators in separate containers. These containers, which should be moisture-proof and made of electrically non-conducting materials, should be placed in a hole or recess in the rib at least 20 feet away from the point where other explosives are kept and where there is no danger of being struck by flying missiles from blasting or from falls of roof.

BLASTING OPERATIONS

Preparation of Face and Undercutting Coal

For safety and economy in blasting operations, miners and shot-firers should be furnished with suitable tools for charging and tamping the boreholes. After the coal in a working place has been cleaned up, the face should be prepared for another round of blasting by squaring up the corners and eliminating overhang. This can be done with a pick. Electric chain-cutters are now commonly used for making an undercut, middle cut, or overcut; this furnishes an additional free face and facilitates bringing down the coal when blasted. A uniform cut gives the best results. A good lumpy product cannot be obtained in a place where the machine has sumped in at an angle to the line of sights and has finished the cut by pulling out on the other side also at an angle to line of sights. "Bug dust," a term applied to the fine cuttings made by an undercutting machine, should be thoroughly removed from the cut in order to get the best results. The use of water jets on the cutter bars greatly reduces the production of and danger from dry coal dust. In some cases a further advantage for blasting effects is obtained by hand snubbing. In this operation a wedge-shaped portion of coal is removed above the undercut with a pick. Short low holes lightly charged with explosive are sometimes used in place of hand snubbing.

Drilling and Charging Shot-Holes

The boreholes, in which the charges of explosives are placed, are usually drilled by hand with breast or post augers. To some extent electrically driven augers are replacing this type. As a rule it is necessary to drill at least one rib hole on each side of a working place, but the total number of holes necessary in a round will depend upon the physical characteristics of the coal as to friability and upon the nature and thickness of bands of slate and bone when present.

Drill cuttings should be entirely removed from the holes, otherwise they may become lodged between the cartridges of explosive and may result in an incomplete detonation of the charge.

The employment of shot-firers tends toward safety and economy in any mine. They should charge the explosive in the holes, tamp and fire all shots. The shot-firers should refuse to charge any holes not properly placed by the miner.

In charging a hole, the cartridges used for a charge should be placed in the mouth of the bore-hole. They should be pushed to the back of the hole at the same time by means of a wooden tamping bar. The preparation of a primer, which is made from the last cartridge placed in the hole, should only be carried out by the shot-firer. An electric detonator is inserted in the primer cartridge so that the charged end of the detonator points toward the main body of the explosive charge.

The twisting together of the ends of the legs of electric detonators, until such times as connections are made to the leading wires, is a precaution against stray currents. A similar twisting of the ends of the leading wires at the battery or magneto end, just prior to firing the shot, is also a precaution against stray currents. A duplex cable 100 feet long should be used for the leading wires between the electric detonator and the battery or magneto used for firing the shot. After inserting the last cartridge the remaining portion of the hole should be completed, filled to the collar with non-combustible stemming.

Stemming

Moist plastic clay is probably the best material to use for stemming. All stemming should be delivered to the miner within a short distance of his working place and should be made up by the miner into dummy cartridges, which should be placed as near as possible to the mouth of each hole for use by the shot-firer. Under no circumstances should coal or other combustible material be used for stemming.

Testing for Gas Prior to Shooting

A shot should not be fired without first testing for the presence of inflammable gas by means of a permissible flame safety lamp and only when there is found to be less than 2 percent present. Neither should a shot be fired when there is an accumulation of dry coal dust adjacent to the drill-hole. Not until everything is in readiness for firing should the legs of the electric detonator be attached to the leading wires and then the other ends to the battery or magneto.

Shotfiring Devices and Functions of the Shotfirer

Figure 1 shows six of the approved single-shot blasting equipments. The larger sized Edison lamp battery and attachment therefor is not shown but is similar to the smaller battery. The U. S. Bureau of Mines requirements for the approvals differ according to whether the device is of the battery or magneto type. Both types are investigated as to the likelihood of their igniting gas and both are tested for reliability and endurance. When the shot is fired the shot-firer should see that no person is in any danger from flying pieces of coal and proper warning should be given to all workers and particularly to those in adjacent working places when the rib is thin and when the shot is liable to break through to some other working place.

The electric blasting system where all shots are fired electrically from the surface when all persons, including the shot-firers themselves, are out of the mine, has been described by Harrington[6]. He says that more than 60 percent of the coal output of Utah comes from mines using this system and that well over 50,000,000 tons of that State's total of 85,000,000 tons have been produced without the loss of one life. He further states that this system is used by nine coal mining companies in Utah, by a large mine in Colorado, another in New Mexico, and at other places.

Danger of Returning too Soon to Faces Shot Down

Many accidents occur on account of men returning too soon after a blast. Some are injured as the result of suffocation and others by delayed shots.

All places after shooting a shot should be examined by the shot-firer as soon as practicable and a test made for inflammable gas. If it is necessary to place props for the support of the roof, the shot-firer should instruct the miner as to manner of placing them. Where shots have been fired, just before leaving the mine the miner or shot-firer should visit and examine the places where shots have been fired, before leaving the mine, to see that there is no fire or any other danger existing.

When shot-firers shoot the charges after all other employes are out of the mine, firing should commence farthest from the intake air current and proceed against the air current. Where a shot misfires, men should not return to the face until after a lapse of at least 10 and preferably 30 minutes where electric detonators are used. In the writer's opinion no attempt should be made to withdraw the stemming or charge in case of a misfire. Another hole should be drilled at least 2 feet from the misfired hole and parallel to it. This hole should then be charged and fired. Care must be taken that the second hole is not drilled into the misfired charge because it may cause a premature explosion. Care must also be exercised in mining the coal close to the misfired

[6] Harrington, Daniel. Blasting from the surface at coal mines. The explosives Engineer, November, 1925, pp. 367-370.

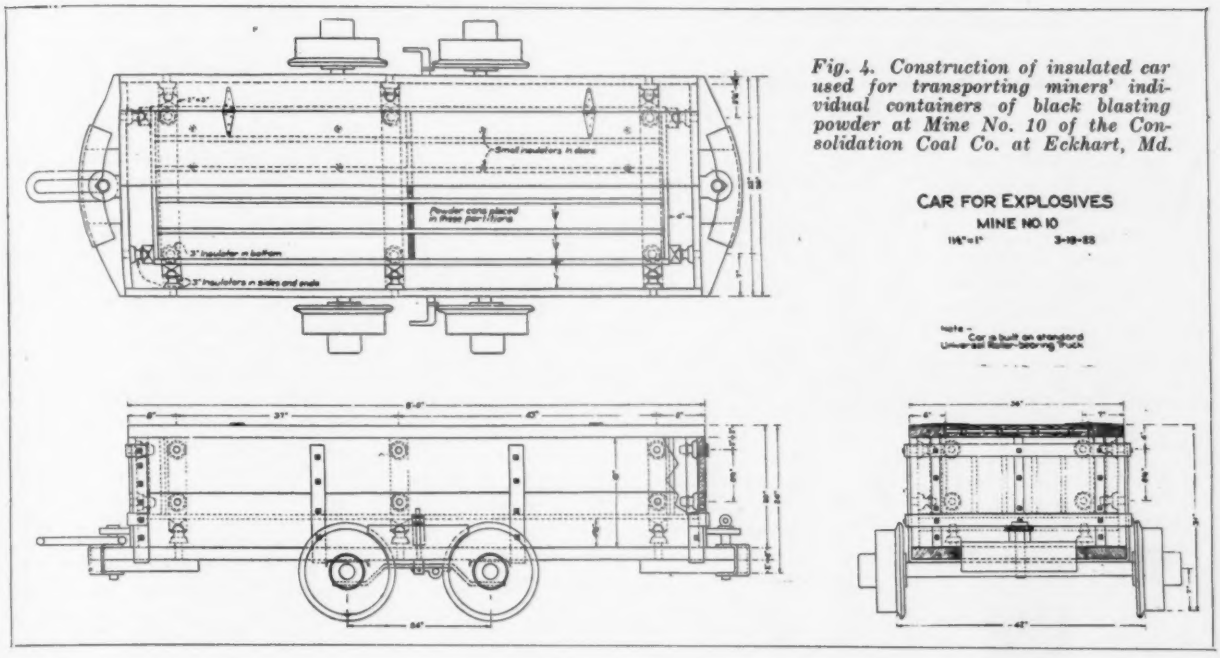


Fig. 4. Construction of insulated car used for transporting miners' individual containers of black blasting powder at Mine No. 10 of the Consolidation Coal Co. at Eckhart, Md.

charge. Accidents have been caused by striking unexploded charges with a pick. The "brushing" of roof or bottom or other rock work in coal mines, should be performed by the use of permissible explosives. The same precautions for blasting must be taken as when shooting in coal.

Electric blasting is safer than any other means of firing shots and on no account should blasting caps or detonators be used with fuse in gaseous mines, because either the open flame necessary to light the fuse, or the spit of the fuse itself may ignite inflammable gas mixtures.

"Short fusing," a term applied to the dangerous practice of using a very short piece of fuse, has caused many premature blasts with attendant fatalities. Black blasting powder is often ignited by the use of squibs but their use should be discouraged owing to the liability of misfires. When used, the match should never be shortened, saturated with oil or ignited except at the extreme end.

The Bureau of Mines recommends and hopes that as soon as the coal mining industry can arrange to do so, all coal mines will use only permissible explosives, fired electrically, and that as an aid to blasting all coal which it is feasible to cut will be cut or sheared.

ACCIDENT PREVENTION CONFERENCE

(*Continued from page* 573)

table forms adopted by the International Association of Industrial Accident Boards and Commissions.

RESOLUTION No. 3

WHEREAS, dependable accident rates showing accident occurrence in relation to amount of employment or exposure are indispensable as a guide to accident prevention; and

WHEREAS, such accident rates on a national scale are dependent upon development in the first instance of the necessary data in the several states, and

WHEREAS, the states generally recognized by laws requiring accident recording and reporting the necessity of securing one part of the data for accident rates; namely, the occurrence of accidents, and

WHEREAS, the recording and reporting of exposure in terms of amount of employment is equally necessary for accident rates; Therefore be it

Resolved, That this conference recommends that the states should put this entire matter where it belongs as a matter of necessary information for the guidance of safety work, both public and private, by supplementing present accident reporting laws so as to provide specifically, in case such laws do not already provide for it, that employers shall furnish such information concerning numbers of employes and amount of employment as may be necessary for the purpose of compiling accident frequency and severity rates by industries.

WHEREAS, the importance of the subjects which have come before this conference and their bearing upon the securing of more complete statistics, and also the prevention of industrial accidents in many cases, calls for information and experience not available now, but which could be developed at future conferences of this nature, and

WHEREAS, to accomplish the results which this conference aims to achieve can only be secured through further educational efforts and experience, this committee believes it is desirable that the Secretary of Labor call an annual conference at Washington for the continuance of the constructive work in connection with industrial accident statistics and industrial accident prevention which has originated in this conference.

Fig. 5. Photograph of car in the above drawing.

"Guides to ore in the Leadville district, Colo.," is the title of a bulletin issued by the Geological Survey. This report focuses attention on ore hunting and the structural and stratigraphic features of the district that have been most influential in controlling the distribution and extent of its ore bodies, without going into details regarding geologic features that are treated in the usual geological survey reports on mining districts. The report contains a section on ore reserves. A further report containing maps and sections will be ready for distribution later.

MINE FIRES AND METHODS OF HANDLING

A Description Of The Fires Caused By Spontaneous Combustion In The Mines Of The Union Pacific Coal Company, At Cumberland and Hanna, Wyoming

By GEORGE B. PRYDE*

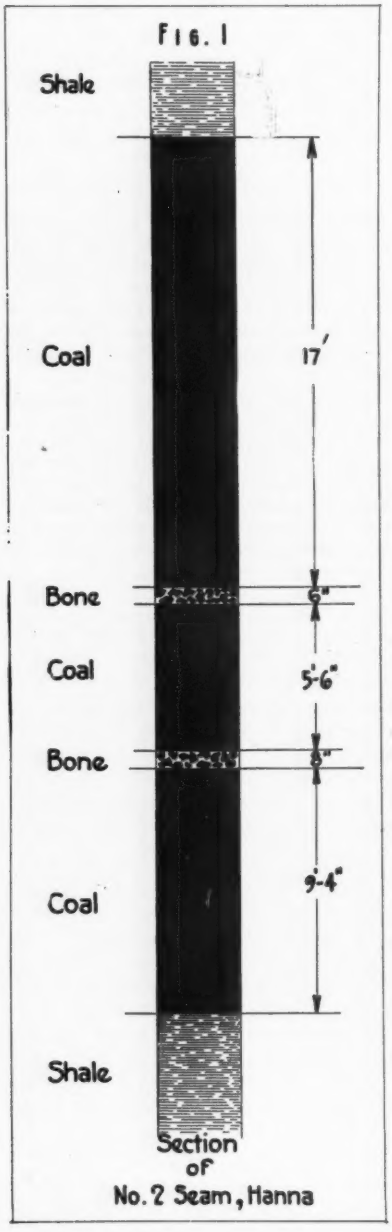
MINE FIRES may be divided into two classes, those in which the fire originates from electric arcing, open lights, use of black blasting powder, etc., and those caused by spontaneous combustion. In the mines of The Union Pacific Coal Co. at Cumberland and Hanna, Wyo., many fires have developed from the latter source. The coal in these districts is of different classification, Cumberland being mined in the Frontier formation, while Hanna is mined in what is known as the Upper Cretaceous bed, which is very much later geologically than the Frontier bed. The Hanna coal, while classed as sub-bituminous, is in reality a high grade lignite, having fairly high moisture content, whereas the coal from the Cumberland mines is a bituminous coal, the moisture content being very much less than that of the Hanna coal. A comparison of the analysis of these coals, given below, will show their wide variance in composition.

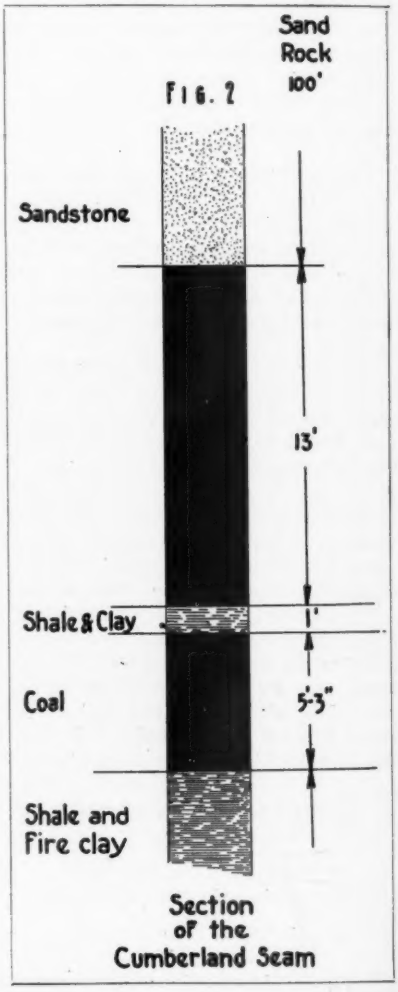
* Vice President and General Mgr., Union Pacific Coal Co., Rock Springs, Wyo.

	Hanna	Cumberland
Moisture	9.33	5.03
Volatile Combustible	45.72	40.10
Fixed Carbon	37.77	50.54
Ash	7.18	4.33
	100.00	100.00
Sulphur	0.31	0.50
B. T. U.	11,455	12,721
Dip	16°	22°

Fig. 1 and Fig. 2 give section of coal seam together with roof and floor.

Fires at Cumberland, nearly all of which have occurred in No. 2 Mine, have been caused, no doubt, by "nigger heads" in the lower part of the seam underneath the shale and fire clay bands. The "nigger heads" weigh from 100 pounds to 400 pounds and are composed largely of pyrites of iron. The coal is mined under heavy overburden, reaching as high as 1,500 feet, and the heat generated by the grinding of the pillars on the pyrites of iron boulders, together with the moisture, evidently develops enough heat through this agency to ignite the coal. The process of combustion is very slow as the fire in nearly all cases has developed in pillar work. There are cases on record where it has taken as long as six weeks to definitely locate the exact position of the fire. The method of handling is to keep a steady stream of water playing upon the fire area, retarding combustion as much as possible, until the burned coal can be loaded out. A covering of adobe has been found very useful in retarding combustion. If these methods are found impracticable on account of the magnitude of the fire, then recourse is had to sealing the affected area. This is accomplished by building stoppings with wooden blocks as shown in Fig. 3 and Fig. 4. Stopping blocks (minimum 4 ft. in length) are laid up in a mixture of clay and sand, and tightly wedged. It has been found necessary in some instances, on account of the great height of the seam and the large size stopping required, to use stopping blocks with a length of 12 ft., particularly at the base. This type of stopping has been used for many years in sealing mine fires in both Hanna and Cumberland districts, and it has proven extremely serviceable, because, on account of the great roof pressure and the very great weight on the stopping, the wooden blocks become securely wedged and make a very effective sealing. It was found a stopping of concrete or rock would break under the pressure, hence the adoption of the wooden stopping. Inside the stopping loose adobe is piled to prevent the blocks from catching fire in the event the fire should again become active by obtaining air through crevices in the coal. Loose adobe in quantities is also so piled in front of the stoppings, especially the large stoppings, that it would be placed in suspension





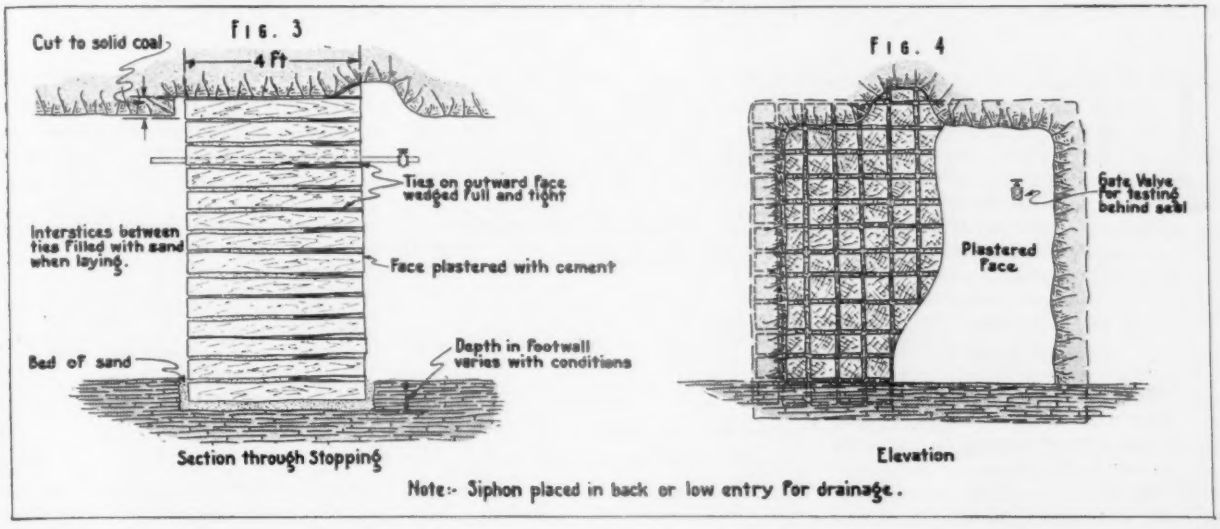


Fig. 3
Cut to solid coal
4 Ft
Ties on outward face wedged full and tight
Interstices between ties filled with sand when laying.
Face plastered with cement
Bed of sand
Depth in footwall varies with conditions
Section through Stopping
Fig. 4
Gate Valve for testing behind seal
Plastered Face
Elevation
Note:- Siphon placed in back or low entry for drainage.

and aid in extinguishing a fire should a cave-in in the enclosed fire area dislodge a stopping with resulting flame. With the adoption of rock dusting more recently, rock dust barriers have been placed in front of the stoppings with the same object in view. Pipes with gate valves are also placed in all stoppings so that thermometers may be inserted and the temperature taken; this also provides means of obtaining gas samples for analysis. Both at Cumberland and Hanna a system of close inspection of all fire areas is maintained.

Fires at Hanna, although of spontaneous origin as at Cumberland, develop from a different source. In these mines we do not find the boulders of pyrites of iron. The higher moisture content of this coal evidently causes rapid oxidation as the coal even in loose piles in rooms will fire if left for a period of any considerable time. When the mines operate irregularly it is therefore necessary that the top bench be not shot down too far in advance of the mechanical loading unit. Fires here also develop in the pillar work on account of the roof pressure grinding the pillars and generating enough heat to ignite the coal, and, as at Cumberland, these fires are hard to locate. Some fires are found close to the edge of the pillars and little difficulty is experienced in loading them out. The system of handling fires at Hanna is very similar to that employed at Cumberland, except that it has been found necessary to build a line of emergency stoppings (nearly completed) from 200 ft. to 250 ft. outside of the permanent stoppings, which can be sealed quickly in the event of damage to the permanent stoppings.

It has been learned that a pile of Hanna coal beginning to heat will rapidly cool off when a strong current of air is allowed to play on it. In storing Hanna coal on the outside no difficulty is experienced with fires on stock piles over periods of several months.

Once a fire develops at Hanna the affected area is never reopened, while at Cumberland after a period of years entries that were formerly on fire have been reopened and worked successfully.

When black powder was used exclusively for blasting, in Hanna as well as Cumberland, frequent fires occurred at the faces of narrow work, such as entries, slopes, etc., but since permissible powder has been substituted not a single fire has occurred from blasting operations in either of these districts.

ROOF CONTROL AND MINE METHODS

(*Continued from page* 584)

this method. At the beginning we did lose one face. We tried to break the roof about 30 or 35 feet behind the face and it went over. *Q.* In substance your theory is to hold the roof as rigid as possible and break it sheer at that point and not let any flexation enter into the work? *A.* If we could set our props without tap pieces even, we save ourselves a lot of trouble. *Q.* You shoot the coal down over the conveyor? *A.* We fire our shots one minute apart working on a 250-foot cut. *Q.* What percentage of the cut was moved with the shoveling? *A.* About 10 percent I would say is shot down on the conveyor, and, of course, there is quite a percentage of it that would be dragged on to the conveyor. *Q.* Then 90 percent must be shoveled? *A.* Yes. *Q.* The conveyor is jammed against the face? *A.* Yes. *Q.* Have you thought that if you had a small mobile loading unit that would pick that coal up without the hand shoveling that you could effect a further economy? *A.* Yes. We haven't found a loader yet that we think will work in there satisfactorily. *Q.* Can you tell me the number of men employed in loading coal? *A.* Our underground forces are now about 9 or 10 tons per man. Before it was about 5 or 6 tons per man. *Q.* What are your proportions of lump and slack? Do you screen it? *A.* Twenty, 40, and 40. *Q.* What are the relative prices of the different grades. *A.* Four dollars a ton for lump, and three or three and a half for nut."

MR. ENZIAN:

"Mr. Knox, would you care to give us a cycle? How many men are employed in the timbering and how many are engaged in undercutting and how many in shoveling? Also, how long does it take to make a complete cycle?"

MR. KNOX:

"I might say for the last year we have not failed to clean up a face every working day except in one case; that is, on the basis of one shift in 24 hours."

"*Q.* What percentage of timber can you recover? *A.* At the present time we are using old timber, and I would say that we are not recovering more than 50 percent at this time. *Q.* Do you have any difficulty in moving the breaking timbers? *A.* Yes. There is a great deal of timber that we have to shoot with a fourth of a stick of dynamite. We don't attempt this if the weight is too great. *Q.* Is this face advancing, and how do you protect your roadways? *A.* Yes; we have a block pillar between the face and the haulage way. *Q.* How thick a pillar is that? *A.* About 30 or 35 feet."

MR. MCAULIFFE:

"I would like to ask Mr. McCullough to reaffirm the statement of Mr. Knox regarding a definite support at the breaking line."

MR. MCCULLOUGH:

"I think Mr. Knox made it very plain that a definite rigid support is the essence of success, and if we can not get that definite rigid support to cause a break at the support we have to revert to old step face. Mr. Knox does not get rigid support at his Sweet Water mine. I venture to say that it is Mr. Knox's opinion that if he had a rigid jack that he would accomplish a very material saving over his old system of mining."

The American Petroleum Institute is working through 10 committees, made up of 375 members, on a program of standardization. It is estimated by the committee on belting that a saving of $1,000,000 is being made possible through simplification and the setting up of better standards of production.

MANGANESE PRODUCTION INCREASES IN 1925*

THE shipments of high-grade manganese ore containing 35 percent or more of manganese, from the mines in the United States in 1925, made a large increase over the shipments in 1924. The shipments in 1925 by 42 producers amounted to 98,324 gross tons, as compared with 56,515 gross tons by 39 in 1924, showing an increase of 74 percent. This increase was due to the shipments from Montana. This state produced considerably more high-grade manganese ore than all the other states combined, the Butte District having furnished 47,507 tons of rhodochrosite, which was utilized mainly in the manufacture of ferro-manganese. Shipments from this district are not regular year by year, and occur only when a considerable tonnage has been developed through the mining of the zinc ore. The second largest individual shipper of metallurgical ore was the Crescent Mine in the Olympic Mountain Region, Clallam County, Washington, from which the shipments for the year were 8,113 tons, averaging 51.64 percent manganese. Being overshadowed by the shipments of metallurgical (*Continued on page* 603)

* The statistical tables here shown were compiled by Miss H. M. Meyer of the Bureau of Mines, Department of Commerce.

MANGANESE ORE IMPORTED INTO THE UNITED STATES, 1924-1925 *
(General Imports)

Country	1924 Gross tons	1924 Manganese content	1924 Value	1925 Gross tons	1925 Manganese content	1925 Value
Africa:						
British West	23,034		$266,216	31,750		$322,360
Brazil	54,938		1,392,536	109,650		2,755,876
Canada	60		3,222	1,199		49,406
Chile	1,178		37,858	3,434		64,608
China	.....		.....	245		12,000
Cuba	†		347,874	†		253,315
Germany	48		5,659	46		6,195
Hongkong	278		8,838	622		22,528
India (British)	54,566		1,340,119	23,504		550,871
Netherlands	3,632		153,709	5		637
Russia in Europe	41,097		1,050,832	114,537		4,101,070
Turkey in Europe	52,557		1,429,788	.....		.....
United Kingdom	5		209	1,572		119,788
	‡231,393		6,036,860	‡286,564		8,258,654

* According to the Bureau of Foreign and Domestic Commerce.
† The imports from Cuba are recorded as 23,065 tons of ore in 1924; and as 12,745 tons in 1925.
‡ Exclusive of the manganese content of Cuban ores.

MANGANESE AND MANGANIFEROUS ORE (EXCLUSIVE OF FLUXING ORE) SHIPPED FROM MINES IN THE UNITED STATES IN 1924, BY STATES, IN GROSS TONS

State	Ore containing 35 percent or more of manganese: Number of shippers	Shipments	Value	Ore containing 10 to 35 percent of manganese: Number of shippers	Shipments	Value	Ore containing 5 to 10 percent of manganese: Number of shippers	Shipments	Value
METALLURGICAL:									
Alabama	3	1,242	$24,954	9	611	$6,722	..	.....	.....
Arizona	1	42	798	..	.....	.....	..	.....	.....
Arkansas	6	3,400	60,350	6	7,991	37,170	..	.....	.....
California	2	850	*	..	.....	.....	..	.....	.....
Colorado	2	5,338	48,042	7	27,058	109,289	1	3,891	*
Georgia	8	1,093	18,304	19	14,182	73,684	6	6,353	$16,558
Michigan	..	.....	.....	1	50,556	157,184	1	39,939	*
Minnesota	..	.....	.....	4	159,915	439,132	3	361,527	970,351
Montana	3	11,933	123,456	..	.....	.....	..	.....	.....
Nevada	3	1,310	13,579	3	2,591	15,997	..	.....	.....
New Mexico	2	775	*	2	23,246	*	..	.....	.....
Tennessee	2	455	11,611	..	.....	.....	..	.....	.....
Utah	..	.....	.....	2	116	1,010	..	.....	.....
Virginia	2	440	*	2	204	*	..	.....	.....
Washington	1	5,000	100,000	..	.....	.....	..	.....	.....
Wisconsin	..	.....	.....	..	.....	.....	1	175,316	606,593
Undistributed	..	.....	39,920	..	.....	89,202	..	.....	120,441
	35	31,878	441,014	55	286,470	929,390	12	587,026	1,713,943
CHEMICAL:									
Montana	3	23,512	816,463	..	.....	.....	..	.....	.....
Virginia	1	1,125	50,000	..	.....	.....	..	.....	.....
	4	24,637	866,463	..	.....	.....	..	.....	.....

* Included under undistributed.

MANGANESE AND MANGANIFEROUS ORE (EXCLUSIVE OF FLUXING ORE) SHIPPED FROM MINES IN THE UNITED STATES IN 1925, BY STATES, IN GROSS TONS

State	Ore containing 35 percent or more of manganese: Number of shippers	Shipments	Value	Ore containing 10 to 35 percent of manganese: Number of shippers	Shipments	Value	Ore containing 5 to 10 percent of manganese: Number of shippers	Shipments	Value
METALLURGICAL:									
Alabama	2	938	$12,544	5	298	$3,087	..	.....	.....
Arizona	3	294	5,102	..	.....	.....	..	.....	.....
Arkansas	4	3,517	79,335	9	5,076	23,140	..	.....	.....
California	3	869	17,525	..	.....	.....	..	.....	.....
Colorado	1	743	5,127	5	7,352	26,565	..	.....	.....
Georgia	8	1,649	20,281	20	28,038	133,215	5	7,349	$23,397
Massachusetts	1	*	*	1	*	*	..	.....	.....
Michigan	..	.....	.....	2	98,753	*	..	.....	.....
Minnesota	..	.....	.....	3	77,665	184,121	4	741,409	1,577,301
Montana	4	55,659	585,031	..	.....	.....	..	.....	.....
Nevada	2	850	*	1	6,659	*	..	.....	.....
New Mexico	2	1,588	*	2	40,848	153,251	..	.....	.....
North Carolina	2	*	*	..	.....	.....	..	.....	.....
Tennessee	1	352	8,800	1	*	*	..	.....	.....
Utah	1	50	*	3	666	5,754	1	496	*
Virginia	3	1,499	22,981	1	1,800	*	..	.....	.....
Washington	1	8,113	*	..	.....	.....	..	.....	.....
Wisconsin	..	.....	.....	..	.....	.....	1	404,014	*
Undistributed	..	52	198,073	..	97	386,183	..	.....	1,198,705
	38	76,173	954,799	53	267,252	915,316	11	1,153,268	2,799,403
CHEMICAL:									
Montana	3	20,529	825,970	..	.....	.....	..	.....	.....
Virginia	1	1,622	77,000	..	.....	.....	..	.....	.....
	4	22,151	902,970	..	.....	.....	..	.....	.....

* Included under undistributed.

SILVER, COPPER, LEAD AND ZINC IN THE CENTRAL STATES IN 1925

THE following statistics of silver, copper, lead, and zinc in the Central States in 1925, compiled for the Department of Commerce by J. P. Dunlop, of the Bureau of Mines, give the production, value, tenor of ore, and average prices for the various States and for the large mining regions.

MINE PRODUCTION OF RECOVERABLE SILVER, COPPER, LEAD, AND ZINC IN THE CENTRAL STATES IN 1925, BY STATES

State	Silver		Copper	
	Fine ounces	Value	Fine ounces	Value
Arkansas	3,118	$2,164	.....	.....
Illinois	3,000	2,082	.....	.....
Michigan	139,499	96,812	155,157,488	$22,032,363
Missouri	83,340	57,838	12,100	1,718
1925	228,957	158,896	155,169,588	22,034,081
1924	242,966	162,787	135,845,416	17,795,749

State	Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	
Arkansas	58	$10,092	43	$6,536	$18,792
Illinois	1,001	174,174	2,724	414,048	590,304
Kansas	22,775	3,962,850	118,778	18,054,256	22,017,106
Kentucky	152	26,448	429	65,208	91,656
Michigan	.....	.....	.....	.....	22,129,175
Missouri	211,566	36,812,484	14,794	2,248,688	39,120,728
Oklahoma	79,946	13,910,604	283,371	43,072,392	56,982,996
Wisconsin	1,877	326,598	20,230	3,074,960	3,401,558
1924	317,375	55,223,250	440,369	66,936,088	144,352,315
1925	282,760	45,241,600	404,484	52,582,920	115,783,056

Value computed at the following average prices for 1925: Silver, $0.694 per ounce; copper, $0.142 per pound; lead, $0.087 per pound; zinc, $0.076 per pound.

MINE PRODUCTION OF LEAD AND ZINC IN THE CENTRAL STATES IN 1925, BY REGIONS

Region	Lead(a)		Zinc(b)		Total value
	Short tons	Value	Short tons	Value	
	Concentrates				
Joplin	136,408	$15,988,612	806,050	$41,332,561	$57,321,173
Southeastern Missouri	314,403	31,727,170	.....	.....	31,727,170
Upper Mississippi Valley(c)	3,249	343,226	88,511	1,926,100	2,269,326
Kentucky and Southern Illinois	1,048	99,543	1,880	65,540	165,083
Northern Arkansas	93	8,546	102	4,676	13,222
1925	455,201	48,167,097	896,543	43,328,877	91,495,974
1924	415,640	37,824,657	806,112	31,801,538	69,626,195
	Recoverable Metal				
Joplin	105,372	18,334,728	416,943	63,375,336	81,710,064
Southeastern Missouri	208,915	36,351,210	.....	.....	36,351,210
Upper Mississippi Valley(c)	2,355	409,770	22,587	3,433,224	3,842,994
Kentucky and Southern Illinois	675	117,450	796	120,992	238,442
Northern Arkansas	58	10,092	43	6,536	16,628
1925	317,375	55,223,250	440,369	66,936,088	122,159,338
1924	282,760	45,241,600	404,484	52,582,920	97,824,520

(a) Includes both galena and a small quantity of lead carbonate concentrates.
(b) Includes sphalerite and a small quantity of zinc carbonate and zinc silicate concentrates.
(c) Includes Iowa, Northern Illinois, and Wisconsin.

TENOR OF CRUDE LEAD AND ZINC ORE AND CONCENTRATES PRODUCED IN THE PRINCIPAL REGIONS OF THE CENTRAL STATES IN 1925

	N'th'n Illinois	Wisconsin	S'theast'n Missouri	S'thwest'n Missouri	Kansas	Oklahoma
Total crude ore mined and milled.....short tons	232,000	1,003,700	6,209,800	662,200	4,165,000	10,605,200
Lead concentrates in crude ore.....percent	0.27	0.26	5.06	0.54	0.76	1.01
Zinc concentrates in crude ore.....do...	4.89	7.62	.....	4.34	5.52	5.13
Metal content of crude ore:						
Lead.....do...	.21	.19	3.43	.41	.60	.80
Zinc.....do...	1.28	2.53	.....	2.54	3.27	3.01
Average lead content of galena concentrates.....do...	78.6	72.8	67.6	76.8	78.9	78.9
Average lead content of lead carbonate concentrates.....do...	.....	.....	.....	60.0	60.0	.....
Average zinc content of sphalerite concentrates.....do...	26.3	32.8	.....	60.8	59.1	58.6
Average zinc content of silicate and carbonate.....do...	.....	34.1	.....	38.2	37.0	.....
Average value per ton:						
Galena concentrates	$105.71	$105.62	$100.91	$110.51	$115.39	$117.13
Lead carbonate concentrates	.....	.....	.....	$ 85.73	$ 87.12	.....
Sphalerite concentrates	$ 15.64	$ 22.66	.....	$ 54.18	$ 52.70	$ 50.64
Zinc silicates and carbonates	.....	$22.51	.....	$ 31.24	$ 30.00	.....

The galena from Southern Illinois (797 tons) had an average lead content of 69 percent, and that from Kentucky (251 tons) had 61.7 percent. Sphalerite from Southern Illinois had an average zinc content of 59.9 percent.

Copper ore from Michigan amounted to 7,036,751 tons and yielded 1.1 percent of copper. The quantity of concentrates produced from the treatment of this ore was 241,056,386 pounds.

STATISTICS OF THE COPPER INDUSTRY IN THE UNITED STATES IN 1924 AND 1925

FINAL statistics of the production of copper in the United States in 1924 and 1925 are issued by the Department of Commerce in a statement which has been compiled in the Bureau of Mines. The smelter production of copper from domestic ores showed a small increase in 1925 and established a new peace time production record. Refinery production from domestic sources also increased, but refinery production from foreign sources decreased sufficiently to make the total new refinery production for 1925 lower than that for 1924. Imports of unmanufactured copper and exports of metallic copper also decreased. Domestic withdrawals of new copper increased in 1925 and stocks of refined copper were only a little over one-half as large as stocks at the end of 1924. Blister stocks showed an increase. The average price of copper in 1925 was a little over 1c a pound higher than in 1924. A summary of the statistics for 1925 is given above.

COPPER PRODUCED IN THE UNITED STATES FROM DOMESTIC ORES, 1924-1925
(Smelter output, in pounds fine)

State	1924	1925
Alaska	77,053,492	72,204,166
Arizona	672,365,115	722,653,457
California	49,433,716	46,943,604
Colorado	4,158,612	3,163,211
Idaho	3,148,519	3,144,064
Michigan	145,333,227	138,029,764
Missouri	184,947	12,114
Montana	249,322,394	270,604,676
Nevada	77,281,479	77,137,563
New Mexico	78,145,629	76,467,245
Oregon	716,656	126,107
Pennsylvania	1,263,535	562,240
South Dakota	4,199	2,336
Tennessee	18,251,996	19,789,234
Texas	302	785
Utah	256,531,349	242,730,986
Washington	978,647	1,184,807
Wyoming	.....	331
Undistributed	75,378	113,196
	1,634,249,192	1,674,869,886

Smelter Production

The smelter production of primary copper from domestic sources during 1925 amounted to 1,674,869,886 pounds, an increase of approximately 2 percent. The value of smelter production increased approximately 11 percent in 1925. The average price of 2,634,000,000 pounds of copper delivered during the year, as reported to the Bureau of Mines by selling agencies, was 14.2 cents a pound.

In the following table the production is apportioned to the States in which the copper was mined. The figures represent the content of fine copper in the blister produced, the smelter output of ingot, and anode copper from Michigan.

Refined Copper

The total production of new refined copper in 1925 was 2,205,000,000 pounds, a decrease of 55,000,000 pounds over that in 1924.

SUMMARY OF FEATURES OF THE COPPER INDUSTRY IN THE UNITED STATES IN 1924 AND 1925

	1924	1925
Production of copper:		
Smelter output (pounds)	1,634,249,192	1,674,869,886
Mine production (do.)	1,606,165,018	*
Refinery production of new copper:		
Electrolytic (do.)	1,499,223,447	1,533,995,439
Lake (do.)	145,333,227	138,029,764
Casting (do.)	29,657,925	10,870,144
Total domestic (do.)	1,674,214,599	1,682,895,347
Total domestic and foreign (do.)	2,260,076,010	2,204,573,824
Total new and old copper (do.)	3,037,000,000	3,045,000,000
Ore* produced:		
Copper ore (short tons)	49,178,315	*
Average yield of copper (percent)	1.59	*
Copper-lead and copper-zinc ores (short tons)	219,874	*
Average price per pound (cents)	13.1	14.2
Imports (unmanufactured) (pounds)	768,813,731	652,973,407
Exports of metallic copper † (do.)	1,116,775,136	1,082,369,439
Withdrawn from total supply on domestic account:		
Total new copper (pounds)	1,354,742,564	1,401,012,091
Total new and old copper (do.)	2,131,000,000	2,241,000,000
Stocks of refined copper ‡ (do.)	243,000,000	124,000,000
Stocks of blister and materials in solution ‡	393,000,000	§432,000,000
Value of production in the United States	$214,087,000	$237,832,000
World's production (pounds)	2,945,423,000	*

* Figures not yet available. † Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined material. ‡ At the end of the year. § Subject to revision.

PRIMARY AND SECONDARY COPPER PRODUCED BY REGULAR REFINING PLANTS AND IMPORTED, 1924-1925, IN POUNDS

	1924	1925
Primary:		
Domestic:*		
Electrolytic	1,499,223,447	1,533,995,439
Lake	145,333,227	138,029,764
Casting	29,657,925	10,870,144
	1,674,214,599	1,682,895,347
Foreign:*		
Electrolytic	577,100,034	516,632,530
Casting	8,761,377	5,045,947
Refinery production of new copper	2,260,076,010	2,204,573,824
Imports of refined copper	145,909,968	99,773,546
Total new refined copper made available.	2,405,985,978	2,304,347,370
Secondary:		
Electrolytic	104,281,430	140,349,541
Casting	50,536,678	58,010,653
	154,818,108	198,360,194
	2,560,804,086	2,502,707,564

* The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation of the amounts at this stage of manufacture is not possible.

In addition to their output of metallic copper the regular refining companies produced bluestone (hydrous copper sulphate) having a copper content of 6,754,000 pounds, as compared with 5,766,000 pounds in 1924.

Stocks

STOCKS OF COPPER JANUARY 1, 1921, 1922, 1923, 1924, 1925, AND 1926, IN POUNDS

Year	Refined copper	Blister and material in process of refining†
1921	659,000,000	465,000,000
1922	459,000,000	283,000,000
1923	216,000,000	361,000,000
1924	264,000,000	432,000,000
1925	243,000,000	393,000,000
1926	124,000,000	432,000,000*

* Subject to revision.
† The amounts stated in the last column in the table above do not include copper in stock at foreign smelters or in transit from foreign smelters to refineries in the United States.

Consumption

The new refined copper withdrawn from the total year's supply on domestic account in the United States in 1925 and the method employed in determining it are shown in the table on the following page, which does not include stocks of copper held by consumers.

Imports and Exports

The figures of imports and exports of copper reported by the Bureau of Foreign and Domestic Commerce are shown on the following page.

NOTE—A more comprehensive report, entitled "Copper in 1925," is in preparation and will be published as a part of a general review of the production and resources of gold, silver, lead, zinc, and copper in that year. The brief statement here presented is published in advance of the complete report in response to a demand for official figures at the earliest possible date.

The figures here given are obtained from smelters and refiners and represent the metal actually recovered, in terms of blister and refined copper, from materials treated in 1925. These figures do not exactly correspond with those showing the copper mined during the year, though the variation should not be great. The smelter production and the mine production represent different steps in the production of copper and should not be confused.

MINERAL LAND

The Geological Survey reports that certain Indian lands in New Mexico are prospectively valuable for oil and gas. Lands have been opened to entry through the Salt Lake land office on which oil claims have been filed and which show indications of oil shale.

NEW REFINED COPPER WITHDRAWN FROM TOTAL YEAR'S SUPPLY ON DOMESTIC ACCOUNT, 1924-1925, IN POUNDS

	1924	1925
Total supply of new copper	2,405,985,978	2,304,347,370
Stock at beginning of new year	264,000,000	243,000,000
Total available supply	2,669,985,978	2,547,347,370
Copper exported*	1,072,243,414	1,022,335,279
Stock at end of the year	243,000,000	124,000,000
	1,315,243,414	1,146,335,279
Withdrawn on domestic account	1,354,742,564	1,401,012,091

* Includes refined copper in ingots, bars, rods, or other forms.

COPPER IMPORTED INTO UNITED STATES IN 1925, IN POUNDS

Country	Ore (copper content)	Concentrates (copper content)	Matte and regulus (copper content)	Unrefined black blister and copper in bars, pigs, etc.	Refined in bars, plates rods or other forms	Old and clippings for re-manufacture	Composition metal, copper chief value
Africa:							
British South	65,055	38,950	.....	.....	.....	.....	.....
Portuguese:							
East	383,444	39,897	.....	92,769,600	.....	.....	.....
Other	.....	10,785	.....	.....	.....	.....	.....
Australia	900	.....	227,231	224,415	.....	.....	.....
Canada	41,571,234	2,449,488	96,548	50,500,684	10,110	5,680,470	10,012
Chile	44,554,953	215,560	265,955	59,800,141	96,170,761	285,823	.....
Cuba	5,985,806	25,176,103	.....	.....	.....	2,091,015	57,549
France	229,939	472,400	87,448	100,439	.....	.....	.....
Germany	70,810	128,312	.....	1,160	24,640	1,391,205	241
Mexico	2,220,156	24,771,676	80,000	71,777,809	.....	104,454	20,430
Peru	593,071	82,582	178,750	72,324,746	.....	1,129	.....
Spain	8,897,949	.....	.....	14,419,651	.....	.....	.....
United Kingdom	407,187	107,626	32,259	3,898,193	22,460	520,741	112
Venezuela	.....	.....	.....	1,068,971	.....	.....	4,732
Other Countries	2,661,832	460,243	764,797	12,449,691	3,545,575	353,629	13,873
	107,642,336	53,953,622	1,732,988	379,335,500	99,773,546	10,428,466	106,949
	$13,582,361	$6,491,514	$212,725	$48,870,358	$13,831,407	$1,188,711	$12,080

COPPER EXPORTED FROM THE UNITED STATES, 1924-1925, IN POUNDS

	1924	1925
Ore (copper content), Concentrates (copper content), Unrefined black blister and converter copper (bars, pigs, and other forms)	55,545	* 1,839,093
Refined in ingots, bars, rods, or other forms	1,009,624,992	968,065,437
Rods	62,618,422	54,269,842
Composition metal, copper chief value	84,803	*
Old and scrap	5,194,052	12,105,461
Pipes and tubes	2,649,816	2,784,025
Plates and sheets	6,772,650	12,205,283
Wire	9,743,541	11,665,579
Insulated wire and cable	15,471,458	17,816,993
Other manufactures of copper	4,700,205	3,456,819
	1,116,915,484	1,084,208,532

* Composition metal included with ore, concentrates, etc., in 1925.

MANGANESE IN 1925

(*Continued from page* 600)

ore from the Butte District, the 1925 production of chemical ores from Philipsburg constitutes a very much smaller percentage of the total domestic production than heretofore.

During the year the output from Leadville, Colo., was curtailed because under present prices some of the producers claim they could not operate at a profit. There was a small increase in the shipments from the Batesville-Cushman District, Ark.

The shipments of domestic ore containing 10 to 35 percent manganese (ferruginous manganese ore) decreased in 1925 from 286,470 tons, valued at $929,390 to 267,252 tons, valued at $915,316. This decrease is due to the falling off of production in Colorado and Minnesota, whereas in Michigan and New Mexico decided increases were made. The domestic shipments of ore containing from 5 to 10 percent manganese in 1925 were approximately 100 percent greater than in 1924. This increase is due to more extensive use of ores of this grade (manganiferous iron ores) in the manufacture of pig iron containing small percentages of manganese. It would appear that the demand for ore of this character would continue to increase.

ASPHALT SALES INCREASE IN 1925

SALES of asphalt and asphaltic materials manufactured from petroleum at refineries in the United States during 1925 amounted to a total of 3,178,370 short tons, which is an increase over the 1924 sales of nearly 100,000 tons, or 3 percent, according to the Bureau of Mines, Department of Commerce. These sales were valued at $42,825,770, an increase over 1924 of 19 percent. Of the total sales during 1925, 1,206,700 tons, with a value of $15,305,760, was manufactured from domestic crude petroleum, and 1,971,670 tons, with a value of $27,520,010, was produced from foreign crude petroleum. The Atlantic seaboard refineries held first rank as manufacturers of asphalt in 1925, their sales of 1,313,270 tons (practically all of which was from foreign petroleum) comprising 41 percent of the total for the United States. Asphalt for paving purposes was again the most important variety, its production registering a gain in 1925. Asphalt to be used in the roofing and waterproofing trades was second in importance, but its production remained stationary as compared to 1924.

Sales at the mine of native asphalt and related bitumens in the United States in 1925, including bituminous rock, gilsonite, and wurtzilite (elaterite), amounted to 584,850 short tons, valued at $4,148,400. This is an increase over 1924 of 4 percent in quantity and of 5 percent in value. Kentucky led in the production of these materials. Of the various products bituminous rock was first in quantity and value.

Imports (general) of asphalt of all kinds for 1925 amounted to 122,162 short tons, a decrease from 1924 of 24 percent. Exports in 1925 amounted to 121,849 short tons, of which 89,014 tons was petroleum asphalt.

CURRENT OIL SHALE BIBLIOGRAPHY

Alderson, Victor C.; The Cost of Producing Shale Oil; Mining Journal London, April 24, 1926; pp. 348-9. Shale Oil Can Be Produced at Low Cost; Oil Trade, May, 1926; pp. 68-9, 74. The Cost of Producing Shale Oil; Combustion, June, 1926; pp. 383-5.

Challenger, Frederick, and others; The Sulphur Compounds of Kimmeridge Shale Oil; Journal of the Institution of Petroleum Technologists, London, April, 1926; pp. 106-141.

Estonian Oil Shale Industry in 1925; Petroleum Times, London, April 24, 1926; p. 720.

Gilmore, R. E.; Swinnerton, A. A.; The Development of a Standard Canadian Laboratory Distillation Method for Examination of Oil Shale; Canad. Chem. & Met., 1925, 9; pp. 215-217, 235-239.

Lewis, J. O.; Oil Engines Will Have Plenty of Fuel; Compressed Air Magazine, June, 1926; pp. 1639-44. Warning of Shortage Misinterpreted by Public; California Oil World, May 27; pp. 2, 14, 15.

Lilley, E. R.; The Oil Industry; Van Nostrand Co., New York, 1925. The Shale Oil Industry; pp. 492-504.

Newbronner, K.; Holzheim Shale & Shale Oil; Petroleum Zeitschrift, 1926, 22; pp. 57-61.

INCREASED PRODUCTION OF METALS FROM SECONDARY SOURCES IN 1925

THE recovery of certain metals from secondary sources in 1925 is reported to the Bureau of Mines as valued at $243,570,700, which is $42,992,100 more than in 1924. The increase in the value of all metals, according to J. P. Dunlop, who compiled the figures, was due both to larger quantities of several kinds recovered and to higher average prices of all the metals in 1925. Although the statistics indicated a decline in brass, this is more apparent than actual owing to a better classification of alloys, which increased the quantity of bronze and other alloys containing copper. The quantity of scrap copper treated at regular refineries treating ore showed an increase of about 21,800 tons, and that treated at secondary smelters and used by foundries increased more than 20,400 tons. The copper in alloys other than brass showed an increase of nearly 12,000 tons, while the copper content of brass recovered decreased 22,200 tons. Lead in alloys in 1925 apparently was about the same as in 1924, but secondary pig lead increased about 22,000 tons. Zinc recovered by redistillation, sweating, and remelting increased over 2,500 tons, entirely owing to an increase of about 4,000 tons of redistilled zinc. There was an increase of nearly one-third in the quantity of zinc in alloys other than brass. In addition to the recoveries of zinc as metal and in alloys, large quantities of zinc dross and skimmings are used for lithopone, zinc dust, zinc sulphate, and zinc chloride. The recoveries of tin were about the same in 1925 as in 1924, but the value was considerably higher in 1925. The quantity of tin-plate clippings treated in 1925 increased about 6,000 long tons, and more than 1,000 long tons of old tin cans were detinned. Nearly 25 pounds of tin was recovered per ton of cans and about 34 pounds per ton of tin-plate clippings.

Secondary antimony increased more than 1,400 tons and the value was 87 percent more than in 1924. The recovery of secondary aluminum showed the very large increase in 1925 of 7,350 tons, and that in alloys, mainly No. 12, increased nearly 10,000 tons.

ALABAMA FIRST AID MEET

The eighth annual first aid meet in the state of Alabama was held at Birmingham July 10. Approximately 60 teams competed, and prizes were awarded in each division and individual awards were made to the first and second highest scoring teams in each division.

SECONDARY METALS OF CERTAIN CLASSES RECOVERED IN THE UNITED STATES IN 1924 AND 1925

	1924 Short tons	1924 Value	1925 Short tons	1925 Value
Copper, including that in alloys other than brass	196,500	$51,483,000	250,600	$71,170,400
Brass scrap remelted	274,000	58,444,200	242,300	56,270,800
Lead as metal	90,400	32,720,000	112,420	39,477,100
Lead as alloys	114,100		114,460	
Zinc as metal	58,886	9,020,000	61,430	11,359,000
Zinc in alloys other than in brass and in chemical compounds	10,500		13,300	
Tin as metal	7,700	31,062,100	7,950	35,165,400
Tin in alloys and chemical compounds	23,600		23,000	
Antimony as metal	90	2,025,600	1	3,794,000
Antimony in alloys	9,314		10,839	
Aluminum as metal	10,350	14,596,200	17,700	24,816,000
Aluminum in alloys	16,650		26,300	
Nickel as metal	114	1,227,500	191	1,518,000
Nickel in nonferrous alloys and salts	2,126		2,109	
	.....	200,578,600	.....	243,570,700

SECONDARY COPPER RECOVERED IN 1925, WITH IMPORTS AND EXPORTS OF BRASS AND COPPER SCRAP

	Short tons
Copper as metal	183,700
Copper in alloys other than brass	66,900
	250,600
Copper from new scrap (not including brass)	50,000
Copper from old scrap (not including brass)	200,600
	250,600
Brass scrap remelted:	
New clean scrap	110,000
Old scrap	132,300
	242,300
Copper content of brass scrap:	
New clean scrap	79,200
Old scrap	90,410
	169,610
Total secondary copper (including copper content of brass scrap):	
From new scrap	129,200
From old scrap	291,010
	420,210
Brass scrap imported	5,374
Scrap copper imported	5,214
Brass ingots, scrap, and old exported	48,189
Scrap copper exported	6,053

SECONDARY LEAD RECOVERED IN 1925

	Short tons
Secondary lead recovered by smelters that treat mainly ore	35,146
Secondary lead recovered by smelters that treat only scrap and drosses	77,274
	112,420
Secondary lead recovered in remelted alloys:	
Lead content of antimonial lead scrap treated at regular lead smelters	9,483
Lead content of drosses and scrap alloys treated at secondary smelters	104,977
	114,460
Total secondary lead recovered	226,880

PRIMARY LEAD PRODUCED IN 1925

Refined primary lead produced in the United States:	
From domestic ore	654,921
From foreign ore and base bullion	112,048
Lead content of antimonial lead from foreign and domestic ores and bullion treated at regular smelters	17,043

SECONDARY ZINC RECOVERED IN 1925 AND PRODUCTS MADE FROM ZINC DROSS, SKIMMINGS AND ASHES

	Short tons
Secondary zinc recovered by redistillation	39,181
Secondary zinc recovered by sweating, remelting, etc	22,249
Total zinc recovered unalloyed	61,430
Zinc recovered in alloys other than brass	13,300
Zinc recovered in brass (estimated)	53,300
Zinc dust made from zinc dross	5,813
Zinc dross used for zinc dust (estimated)	6,850
Lithopone made from zinc skimmings and ashes	48,705
Secondary zinc content of lithopone	9,741
Zinc chloride made from zinc skimmings and ashes	45,772
Zinc content of zinc chloride made from skimmings and ashes	10,070
Zinc content of zinc sulphate made from zinc drosses, skimmings, etc	858
Zinc concentrates and ore exported	68,951
Zinc dross exported	15,968

SECONDARY ANTIMONY RECOVERED IN 1925

	Short tons
Secondary antimony in antimonial lead scrap smelted at regular smelters	1,328
Secondary antimony recovered at secondary smelters	9,512
	10,840
Antimony imported in ore, as metal, or as oxide or salts in 1925	13,182
Primary antimonial lead produced at regular smelters	19,667
Antimony content of primary antimonial lead	2,624

SECONDARY ALUMINUM RECOVERED IN 1925

	Short tons
Secondary aluminum recovered unalloyed	17,700
Aluminum recovered in alloys (mainly No. 12)	26,300
	44,000

PRIMARY ALUMINUM PRODUCED, IMPORTED, AND EXPORTED IN 1925

Primary aluminum produced in the United States (estimated)	short tons	72,000
Value of primary aluminum produced in the United States		$36,430,000
Aluminum (crude and semicrude) imported for consumption	pounds	41,997,178
Aluminum (crude and semicrude) exported	do	12,642,034

SECONDARY TIN RECOVERED IN 1925

Recovered as pig tin	short tons	7,950
Tin recovered in alloys and chemical compounds	do	23,000
		30,950
Clean tin-plate scrap treated at detinning plants	long tons	172,432
Old tin-coated containers treated	do	1,167
Metallic tin recovered at detinning plants	pounds	1,932,850
Tin content of tin tetrachloride, tin bichloride, tin oxide, and tin crystals made at detinning plants	pounds	4,264,340
Total tin recovered at detinning plants	pounds	6,197,190
Tin tetrachloride, tin bichloride, tin oxide, and tin crystals made at detinning plants	pounds	8,626,387
Average quantity of tin recovered per long ton of clean tin-plate scrap	do	34
Average quantity of tin recovered per long ton of old tin-coated containers	do	25

TIN AND TIN CONCENTRATES IMPORTED AND TIN PRODUCED FROM IMPORTED CONCENTRATES IN 1925

	Short tons
Tin imported as metal	85,843
Tin concentrates imported	214
Tin produced from foreign concentrates smelted in the United States	.....

SECONDARY NICKEL RECOVERED IN 1925

	Short tons
Nickel recovered as metal	191
Nickel recovered in nonferrous alloys and salts	2,109
	2,300

PRIMARY NICKEL PRODUCED, IMPORTED, AND EXPORTED IN 1925

	Short tons
Nickel produced by a by-product from the electrolytic refining of copper at domestic refineries	272
Nickel imported for consumption in the United States as nickel, or in ores, matte, oxide, and alloys	21,536
Nickel oxide and matte exported	None
Nickel, monel metal, and other alloys exported	1,285

MINE RESCUE AND FIRST AID CONTEST

The Explosives Engineer Trophy, the goal of miners in all parts of the United States, will be awarded during the week of August 30 to September 4 at the International Mine Rescue and First Aid Contest, which is to be held in the Civic Auditorium, San Francisco, under the auspices of the United States Bureau of Mines and the Society of Safety Engineers of California.

The week has been designated as San Francisco Safety Week by the authorities and more than 50 civic organizations are participating in the program. Rescue and first aid teams from the largest mines of Pennsylvania, West Virginia and the Coast states, totaling near 1,000 miners and their trainers, will be present to take part.

Secretary Herbert Hoover, who has been personally interested in the safety work of the mines of the country during the past year has notified the winners of the various classes in a personal letter in which he commended the workers for their progress. The winners, who will send representatives to take part in the contests and be present to receive the award are: The Upper Lehigh Mine of Upper Lehigh, Pa., the United States Coal and Coke Co., of Gary, W. Va.; New York Mining Co., of Picher, Okla.; United States Gypsum Co., of Gypsum, Ohio; North American Cement Co., of Security, Md., and the City of Los Angeles, Harbor Department of Los Angeles, Calif.

The committee in charge of the affair in San Francisco in September consists of Walter A. Chowen, California Inspection Rating Bureau, general chairman; Byron O. Pickard, of the United States Bureau of Mines; E. W. Bullard, P. J. Dunphy, of the Pacific Telephone & Telegraph Co.; R. E. Donovan, of the Standard Oil Co.; S. C. Dickinson, of the Pacific Gas & Electric Co.; H. C. Miller, United States Bureau of Mines; J. A. McGilvray, of the Industrial Accident Commision of California; Mrs. Helen L. Holt, of the California Public Safety Conference; Mrs. R. N. Gray, of the Women's Safety League; J. I. Cahn, of the San Francisco Council, Boy Scouts of America; Miss Julia Hinkle, of the American Red Cross; Sgt. Patrick H. McGeo, of the San Francisco Police Department; Guy C. Macdonald, editor of "The Pacific Safety Engineer."

DISCIPLINE AND SAFETY

(*Continued from page* 592)

rule infractions and that they will not be censured for some one else's error or for incidents beyond their control, they will be ready at all times to cooperate with the management in operating to the highest degree of industrial safety and efficiency.

The relation between discipline and underground safety is therefore close and direct and is one that must not be slighted if accidents are to be prevented. The worker has the burden of responsibility placed squarely on his shoulders and he is never allowed to forget that fact for a moment. The best proof of this is that it works, which after all is the true test of any system.

METHODS AT PORTLAND MINE

(*Continued from page* 590)

pulp is then agitated, de-watered, and the solution sent to the clarifying presses. Zinc dust is used for precipitating. The precipitates are cleaned up twice monthly and shipments of bullion made to the U. S. Mint in Denver.

Wherever possible in the mining operation, the work is contracted. This applies to shaft sinking, drifting, and stoping, and this plan has worked out most satisfactorily in reducing costs and has resulted in an improved labor condition in every way.

Outside of making necessary repairs, work is discontinued on the day shift on Sunday and this policy has prevented frequent shutdowns for repairs during the week and has not decreased the production. Beyond maintaining pumps, no men work on the graveyard shift.

Fortunately we have an exceptionally high type of miners in the Cripple Creek District. There is no organization among them and all men applying for work are required to register and obtain cards from the Mine Owners' Association.

There are many things which could be done which would cut down, in a measure, the cost of our operation and a continuous effort is being made toward this end.

The Portland has, in the past four years, gradually worked its way out of a very heavy indebtedness resulting in part from war and post-war conditions. At the present time it has more ore developed than has been the case in many years. The water condition has been practically unchanged ever since we left the level of the drainage tunnel and we have no reason to believe that the volume will increase. In view of this fact, and also because the mineralized area seems to be increasing with depth, the possibilities for the future of the mine seem greater than they have for many years.

NEWS OF THE MINING FIELD

A Résumé Of The Activities Of The Mining Industry And Items Of Interest In The Field

Sullivan to Erect Electrolytic Plant

According to an announcement made by James F. McCarthy, president of the Sullivan Mining Co., construction of an electrolytic zinc reduction plant at Kellogg, Idaho, will begin at once. It is estimated that the plant will cost $1,000,000. The building of this plant is the culmination of the plan outlined some five years ago by F. W. Bradley, president of the Bunker Hill and Sullivan Mining Co. Stanly Easton, vice president and secretary of the company, in discussing this enterprize, said that the plant will have a capacity for producing 50 tons of refined zinc per day, and that it will be planned with the view to enlarging its capacity as conditions warrant. The plant is being constructed primarily for the treatment of zinc ores from the Star mine owned by the Sullivan Mining Co. It will be operated also as a custom plant for the treatment of zinc concentrate from Pine Creek mines, and from many other mines having a zinc product available to the plant.

New Mill for Galena Progressing

Excavation work for the new 150-ton plant for the Galena mine for the Calahan Zinc-Lead Co. is reported to be progressing satisfactorily. The new plant will be located within a short distance of the shaft, making it possible to handle the ore between the mine and mill at a very low cost.

Alumiaum Co. Enlarges Facilities

According to a statement from the High Commisisoner for Canada the Aluminum Co. of America is employing between 800 and 1,000 men in enlarging the wharves at Port Alfred. It is stated that the company will utilize 31 ships in transporting the necessary bauxite supplies.

Gold Dredges Operating In Alaska

The United States Smelting, Refining and Mining Co. has three dredges operating at its gold dredging enterprise in Alaska. The magnitude of this operation in Alaska can be seen when it is said that the dredges carry an endless chain of buckets capable of digging from 70 to 85 feet below the bottom of the pond. Each bucket digs a cubic yard of gravel or over a ton and a half of material.

Zinc Stocks Decline

Zinc stocks in the hands of American producers on July 1 amounted to 25,760 short tons, compared with 29,934 short tons on June 1, showing a decrease of 4,174 short tons. Shipments in June totaled 52,400 tons of which 6,239 tons were exported. Production in June was 48,226 short tons.

COPPER RESEARCH COMMITTEE ORGANIZED

W. H. Schacht, general manager of the Copper Range Co., is the chairman of a committee composed of representatives of the United States Bureau of Mines, Michigan Geological Survey and the Michigan College of Mines, which will cooperate with the Copper Research Advisory Committee in a study of the various problems of the copper industry in the Michigan district. An executive committee, which will direct the work of research consists of C. H. Benedict, chairman; C. L. Lawton, Alexander Laist, Och Potter, Albert Mendelshon, Theodore Dengler, W. H. Schacht and T. M. Broderick. The committee will study the following problems: "Clarification of Ideas on Various Practice"; "Standardization of Equipment"; "Study of the Physical and Chemical Properties of Copper"; "Magnetic Dip Needle Testing of Small Areas to Determine the Feasibility of This Method of Exploration"; "Drill Steel Testing to Reduce Breakage and Increase Efficiency"; "Accumulation of Information of Deep Mining"; "Study of Rock Pressure and Subsidence"; "Study of Ventilation"; "Study of the Comparative Hardness of the Ores"; "Greater Elimination of Gangue from Mineral to Give a Higher Percentage of Copper"; "Deduction of Copper Losses in Tailings and Slag"; and the "Study of Economics of the Copper Industry and Promotion of New Uses for the Metal."

Humboldt Sulphur to Erect Mill

A 50-ton mill is being erected by the Humboldt Sulphur Co., to treat the ore from its sulphur deposits at Sulphur, Nev. It is understood that operations are to begin soon. Under direction of Arthur J. Crawley the company is planning to develop reserves estimated to contain over 150,000 tons of 35 percent sulphur ore.

A. S. & R. May Purchase Eagle Picher Lead

Negotiations are under way between American Smelting & Refining Co. and the Eagle Picher Lead Co. for the transfer of the properties of the latter company to the former. A statement of John B. Swift, president of the Eagle Picher Lead Co. states:

"The American Smelting & Refining Co. made an offer through the Guaranty Trust Co., New York, to buy the Eagle Picher properties several months ago. We met the officers of the Guggenheim Corporation and held several conferences. It will require a month or more before negotiations have gone far enough to know whether the deal will be accomplished, but on basis of present indications they are likely to be consummated. We asked $45 a share for Eagle Picher common. Our book value showed $34 to $35, but recent appraisal of refineries and plants of company showed a reproduction value of $38,000,000 or $4,500,000 more than former estimates. This is without the values of the mines, appraisal of which will not be completed for a month. There are 20 mines, many of which have large tonnages blocked out."

The company owns extensive mines in the Joplin (Missouri) district and at Picher, Okla., and has elaborate plants at Joplin, Cincinnati, Newark, N. J.; Galena, Kans.; Picher and Henrietta, Okla.; East St. Louis, Ill., and Chicago. The company is one of the oldest of its kind in the country. Eagle White Lead Co. was founded in 1843 and in 1906 took over the Picher Lead Company, an Oklahoma corporation. In 1916 the concerns were consolidated into the Eagle Picher Lead Co. with Oliver S. Picher as president. Following his death two years later, Mr. Swift, who was chairman of the board of directors, became president. The Eagle Picher Lead Co. recently acquired the controlling interest in the Consolidated Zinc and Lead Co., which own extensive lead and zinc mines in eastern Oklahoma.

In addition to its mines and smelting plants, it owns gas and oil fields and a gasoline absorption plant in Oklahoma.

An all steel mill will be erected by the Commerce Mining & Royalty Co., to replace the concentrator destroyed by fire.

Mason Valley Smelter to Start

The Mason Valley Mines Co., at Thompson, Nev., expects to start its smelter in about two weeks. The company has men at work at the smelter getting the plant in shape for operation. The flotation mill at this company's Bluestone mine is milling 800 tons per day of sulphite ore concentrating at the rate of 15 into 1. The mill will be supplied with ore from both the Bluestone and Mason Valley mines.

Nevada Cons. Starts Operation

The Nevada Consolidated Copper Co. has started operation on the properties of the Consolidated Mines Corporation, the work being done under a contract being dated June 23, 1926. This contract which is for a term of 20 years, provides that the Nevada Co. will treat the ores of the Consolidated Co. at its reduction plant at McGill, Nev., and will mine and load steam shovel ore from the Consolidated from its Ora and Emma Nevada mines with Nevada's Liberty Pit Shovel operations. The Consolidated Co. will mine for Nevada's accounts all its ores in the western extension of the Liberty Pit in its Champion and Liberty plants.

National Potash Drills Test Well

The National Potash Co., which has been drilling a diamond core test well for potash near Paducah, Tex., has announced plans to explore potential potash areas in western Texas, according to a statement issued by A. C. Harper, secretary of the company. Five additional test wells will be drilled within the next 12 months. The present well is down more than 1,600 feet, and it is said that the core has shown considerable potash, although to date it has not been found in commercial quantity.

Alabama First Aid Meet

A coal lease on 1,210 acres of public lands in Alaska has been authorized to be issued to the Rawson Coal Co. by the Interior Department.

The land is located in the Matanuska field, Seward Meridian. Under the terms of the lease the company must pay a royalty to the Government of 2 cents per ton, mine run, on all coal produced. It is also required to make an investment of $121,000 on the property during the first five years of the lease.

Issuance of the lease will be made through the local land office at Anchorage, Alaska. The company was awarded the lease under a preference right derived from a permit to explore coal previously issued by the Government on the tract of public land.

Millions Spent to Find Minerals

In a recent statement Ravenel Macbeth, Secretary of the Idaho Mining Association asserts that millions of dollars are being spent annually in the search for new mineral deposits. More than three million dollars were spent in Idaho in 1925, the larger portion of which was spent in the Coeur d'Alene district. Mr. Macbeth's statement in part says:

"The total expenditure last year was $3,083,166, and as compared with the expenditures for each of the two preceding years, 1925 shows an increase of practically 50 percent. In 1923 the total was $1,935,237, and in 1924 it was $2,037,785, and in both these years practically the entire expenditure is represented by money from outside the State. Last year about 70 percent, or $2,100,000, was outside money. The total outlay during the three years in Shoshone county alone was $7,056,188, and from this great investment no profit was derived except by the State of Idaho and the fortunate community in which it was disbursed. This expenditure was more than the entire dividends paid by the profit-earning mines of the Coeur d'Alene district last year. The figures for Shoshone county or the Coeur d'Alene district for 1925 follow:

Non-Producing Development Companies

Labor	$ 804,712.00	
Supplies	360,564.00	
Mine equipment	53,195.00	
Mill equipment	11,570.00	
		$1,230,041.00

234 companies employed 424 men.

Producing Non-Dividend Paying Companies

Labor	$1,071,241.00		
Supplies	534,338.00		
Mine equipment	56,400.00		
Mill equipment	73,198.00		
Tramways	4,000.00		
Ore transportation	104,948.00		
		$1,853,125.00	
			$3,083,166.00

17 companies employed 564 men.
251 companies employed 988 men.

Comparison Mining Expenditures

1923

267 Non-producing development companies expended	$1,436,419.00	
4 Producing non-dividend paying companies expended	498,818.00	
		$1,935,237.00

271 Companies employed 763 men.

1924

246 Non-producing development companies expended	$1,161,777.00	
9 Producing non-dividend paying companies expended	876,008.00	
		$2,037,785.00

255 Companies employed 739 men.

1925

234 Non-producing development companies expended	$1,230,041.00	
17 Producing non-dividend paying companies expended	1,853,125.00	
		$3,083,166.00
251 Companies employed 988 men.		
Total expenditures 1923, 1924, 1925		$7,056,188.00

"Cost assessment work unpatented mining claims, and location work on new mining claims not included in foregoing statement expenditures, 1923, 1924 and 1925."

Mr. Macbeth points out that in 1923 there were four producing non-dividend paying mines in the district, while last year there were 17. Next year some of these, possibly all of them, may be in the dividend paying class.

Canadian Fuel Board Makes Recommendations

The Canadian Fuel Board recently appointed by the Canadian Government to study Canada's coal problem and to suggest ways to make the Dominion less dependent upon foreign supplies, has made its final report to parliament. The report contains the following recommendations:

(1) That trial shipments of Alberta western coal be made by rail and lake under the supervision of the Dominion Fuel Board, in order to ascertain the possibilities of moving Alberta coal in large volume with modern loading and unloading facilities.

(2) That such legislation be enacted as will encourage the production of domestic coke from Canadian coal and make Canada as far as possible independent of foreign sources of supply of domestic fuel.

(3) That the government invite the cooperation of the provinces in the establishment of standards of quality and regulations governing the shipment and the marketing of coal and coke.

(4) That the Dominion Fuel Board, which has greatly assisted in the effort to solve Canada's fuel problem, be encouraged to continue and enlarge its work.

(5) That the duty of 50 cents per ton, now imposed on bituminous slack coal, be extended to apply to anthracite small coal, known to the trade as "buckwheat and pea coal."

(6) That the government consider the question of granting some assistance to encourage the enlargement of the markets for maritime coal.

(7) That the exemption from duty of foreign coal for bunkering ocean-going ships be withdrawn.

(8) That the harbor commissions of Montreal, Toronto and Hamilton be asked to cooperate in arranging better coal-handling facilities at their ports, in order that dispatch may be effected in unloading and loading coal from boats entering their harbors, and that the said harbor commissions be asked to make substantial reductions in harbor dues on Canadian coal.

(9) That the Railway Commission be asked to ascertain and report upon the cost of carrying coal from the Alberta mines to Port Arthur and Fort William.

(10) That early consideration be given by the government as to the advisability of renewing the vote in the estimates for the purpose of assisting the rail movement of Canadian coal, of which the unexpended balance was $180,000.

(11) That, before sanctioning any scheme by the harbor authorities of Vancouver to erect public coal-bunkering facilities, the matter be carefully considered as regards what effect such action might produce on the coal mines of Vancouver Island, inasmuch as coal might be brought in as ballast from other countries at such a low price as would result disastrously to the local coal mines.

(12) That it would be advisable to have an investigation and report made by the officials of the Canadian National Railways upon the possibility of materially increasing the average freight train load, either by impvorements to the lines in gradients or otherwise, or by increase in traction power, with a view to reducing the cost of rail haul from Alberta to the Head of the Lakes, and also upon the costs of effecting such improvements.

New Tipple for Carbon Fuel Co.

The Carbon Fuel Co., of Charleston, W. Va., is erecting a new wooden tipple with shaker screens, loading booms, and other equipment. This company will spend $60,000 in improving its No. 5 and No. 7 mines in Kanawha County.

Consolidation Erects Tipple

The Consolidation Coal Co. will erect a new coal tipple at a cost of $250,000 at its Pinnickinnick plant at Clarksburg. It is understood that this plant will be made a central loading point for railroad fuel.

Fire destroyed the large tipple of the Hutchinson Coal Co. at Montclare. It is understood that the company will replace the tipple with one of steel construction.

Coal Mine Inspectors Appointed

Eight bituminous coal mine inspectors have been appointed by Governor Pinchot, of Pennsylvania. Five of these were re-appointments, including S. S. Hall, of Connellsville; J. I. Thomas, of Johnstown; James V. Walker, of Butler; P. J. Lewis, of Punxsutawney; and W. B. Wardrop, of Barnesboro. The new inspectors are W. G. Knapper, of Philipsburg; Alexander Jack, of Lilly; and P. J. Narian, of Johnstown.

Anthracite Tax Held Constitutional

As a result of the recent decision of the State Supreme Court of Pennsylvania in the case of the Commonwealth vs. the Hudson Coal Co., million. of dollars in anthracite taxes will be collected. The opinion handed down by the court reaffirms the constitutionality of the anthracite tax act of May 11, 1921.

Survey Big Wheeling Creek Tract

Engineers of the Loraine Coal & Dock Co. have been surveying a 16,000 acre tract of coal lands on Big Wheeling Creek, W. Va., with a view, it is reported, to making certain openings. The company purchased this tract about four years ago, although so far no development has been undertaken. If new mines are opened, they will be operated on the non-union scale.

Lignite Contracts Awarded

Awards of contracts by the state of North Dakota for furnishing state institutions with 80,700 tons of lignite fuel have been made to the following concerns: Knife River Coal Mining Co., Republic Coal Co., Rupp Coal Co., Washburn Lignite Coal Co., Stevens Bros., Whittier Prockett Coal Co., Scranton Coal Co., Truax Coal Co., Wisom Coal Co., Lehigh Coal Co., and Pittsburgh Coal Co.

Coal Properties Sold

The properties of the Rockport Coal Co., including mines at Rockport and Centertown, in western Kentucky, were sold on July 10 under court orders to Harry L. Tucker. Mr. Tucker, who has controlled the bankrupt concern for several years, bid $65,000 for the mines which had an appraised value of $233,000. The power plant of the company is practically new, and three years ago over $30,000 was invested in new shaker screens and other equipment. The two mines have a capacity of about 1,500 tons daily.

Tonopah Extension and West End Consolidated Settle Difficulties

A compromise agreement between the Tonopah Extension and West End Consolidated Mining companies brings to a close litigation extending over a period of two years. The agreement awards the West End Co. full ownership of the ore bodies opened up in the West End Extension and Tonopah Seventy-six veins, and establishes vertical rights between the Tonopah Extension and Halifax mines. The West End is entitled to follow the Seventy-six lode and its

branches beneath the Panther and New Jersey claims of the Tonopah Extension, restricted to an area between two parallel planes, and depth to which the vein may be followed is limited to 4,840 feet above sea level. Beyond the planes and below the specified depth the Tonopah Extension has exclusive ownership of the deposits in its own territory.

Anti-Trust Law Suit to be Heard Early in September

The Department of Justice has announced September 13, 1926, as the date upon which the Government's case against the National Malleable Steel Casting Co. of Cleveland, Ohio, charged with violation of the anti-trust laws will be called for trial. Controversies over removal proceedings of 35 of the defendants residing out of the Cleveland district have been decided in favor of the Government with but three exceptions, these still being out of jurisdiction of the court.

Investigation of Petroleum Rates

The Interstate Commerce Commission has instituted an investigation into the rates in petroleum and petroleum products within the territory on the east of the Mississippi River, south of the Ohio River, east of the Indiana-Illinois State line and from points without to points within that territory, with a view to determining whether the rates are unreasonable, unduly prejudicial, or unduly preferential of particular localities. Places for holding hearings will be announced by the commission.

Ruling Changes Tariff

As the result of a ruling by the Assistant Secretary of the Treasury ferro alloy has been transferred from paragraph 374 to paragraph 302 which results in the metal being held dutiable at 25 percent ad valorem instead of a rate of 5 cents per pound raw or 9 cents in scrap or plate. The basis of the decision by the custom authorities was in the method of composing the mixture of the metals.

Reading Wishes Control of L. & N. E. Railway

The Reading Co. has filed an application with the I. C. C. asking authority to acquire control of the Lehigh & New England Railroad by a 999-year lease, dating from January 1, 1927. The Reading Co. claims that the acquisition of this road, which operates 155 miles of line in Pennsylvania, New Jersey, and New York, will enable it to operate through and shorter routes in transporting anthracite from the Schuylkill regions of Pennsylvania to points in eastern and northern New York and New England. They also claim that it would bring about improvements in through routes now existing and enable them to open additional routes to handle traffic between northeastern states and southern, western, southwestern and southeastern points. The Reading would pay $1,069,000 in annual rental, payable quarterly, and would assume liability for equipment, and trust obligations of the road.

Lake Cargo Coal Hearings

Hearings in the reopened lake cargo coal case were begun at Atlantic City, July 20, with representatives of the Illinois coal industry assuming the major part of the task of opposing any changes in the rates on coal from Eastern fields to the lakes. The Illinois Commerce Commission and the Illinois Utilities Board both opposed any reductions in the rates to the docks, unless the benefits thereof were extended to Illinois mines. A. W. Kerr, general counsel for District 12, United Mine Workers, charged that rate revisions in 1915 had cost Illinois 9,000,000 tons of business and had decreased the number of workers from 106,000 to 77,000.

The complainants in this case let it be known that they were opposed to any intervention which would defer a decision. The Illinois representatives insisted that their intervention did not broaden the issues, and declared that in the original decision Illinois was recognized as a party.

Representatives of the Louisville & Nashville intimated that railroads serving Southern fields were opposed to higher rates with a wider differential, from the Southern fields to the lakes.

OHIO COAL ASSOCIATION ORGANIZATION

The Ohio Coal Operators Association, Inc., is the name of the new organization recently created by coal men in session at Columbus, Ohio. S. H. Robbins, president of the Youghiogheny & Ohio Coal Co., was elected president of the Association; Geo. M. Jones, Sunday Creek Coal Co., vice president; A. A. Augustus, of Cleveland, vice president, and John S. Jones, of Columbus, secretary and treasurer. The executive committee consists of these four officers and R. L. Wildermuth, T. K. Maher and W. H. Haskins. The Board of Directors includes in addition to the above mentioned gentlemen Ezra Van Horn, Wm. F. Kutz, W. R. Woodford, W. L. Robinson, E. M. Poston and T. R. Biddle. Two additional directors will be chosen later. The organization will meet in Columbus on August 10 to complete details of organization. A committee was selected to draft a constitution and by-laws, the membership of this committee being John S. Jones, Geo. M. Jones, W. H. Haskins, J. C. Kyle, T. K. Maher, Walter Robinson, L. H. Bray and Wm. Kutz. The meeting was called for the purpose of discussing ways and means to rehabilitate the coal mining industry of Ohio. While the operators expressed a keen desire to be fair to the miners they agreed to adopt such changes in mining conditions in Ohio as will result in the reopening of the mines. Many of these companies have been closed for two years. The following resolution was unanimously adopted:

"Believing that the welfare of the coal industry in the State of Ohio requires that the industry within the state be handled as a unit, we recommend the formation of an organization of the coal operators of the State of Ohio, which will be representative of the industry therein, and that such organization be charged with the duty of developing a broad policy respecting the employment of labor in the mines within the state, giving due consideration to the rights of both employer and the men employed, to the end that the industry be placed upon a basis which, while fair to the miner, will yet permit of the early and general resumption of successful operation of these mines in the competition which they encounter in marketing their coal."

It is believed that the final results of this organization meeting will bring about complete cooperation of every operator in Ohio. It is hoped that the constitution as presented will gain the support of the operators and enable the organization to take the place of several district groups of operators. While the discussions were behind closed doors it is understood that it centered around the decline of mining in Ohio which is the result of the Jacksonville wage scale. None of the operators present talked for publication and it was not learned whether it is the plan of the organization to recommend the employment of non-union miners, attempt to reopen under the 1917 scale, or renew negotiations with the United Mine Workers.

Railroads and opposing intervenors will probably be heard sometime in September.

Jury Finds in Favor of Anderson

John Carter Anderson was awarded his full claim against the Arizona-Superior Mining Co., of Phoenix, Ariz., by a jury which brought out its verdict within 30 minutes. Mr. Anderson had brought suit to recover a fee of $750 for an examination and report upon the company's property. The company had refused to pay the fee and after rejecting the report, brought suit for $50,000 damages for alleged falsity in the report, and conspiracy to depreciate the property.

Increase in Freight Rate Refused

A recent ruling of the Interstate Commerce Commission refuses to grant to western carriers a 5 percent increase in freight rates. The commission holds that from the evidence presented this western district faces no financial emergency. They declare that in this section they appear both financially and physically sound. The record is held open for a further consideration in connection with the commission's investigation.

Thousands Depend Upon Illinois Mines

In a letter to the Interstate Commerce Commission Frank Farrington, president of the United Mine Workers of Illinois, urged a reduction of freight rates upon coal produced and originating in the various sections of the country. Mr. Farrington urged consideration of this matter asserting that the families dependent upon the mining industry of Illinois represent an aggregation of nearly 500,000 men, women and children.

Attempt to Readjust Wages

The Southwestern Interstate Coal Operators Association in a recent attempt to readjust wages in the coal fields of Kansas, Missouri, Arkansas and Oklahoma addressed a letter to John L. Lewis, president of the United Mine Workers of America, in which they pointed out that competition with fields where production costs are less and competition with mines in fields which are operating under the open-shop plan call for an immediate reconsideration of the present contract. Mr. Lewis declined to reconsider the contract at this time, stating that certain factors of a local nature have operated to the disadvantage of the industry in the southwest and can not property be charged to wage rates.

Coal Mine Inspectors Not Subject to Terms Agreement with United Mine Workers

A recent decision of the Anthracite Conciliation Board declares that coal inspectors do not come under the terms of the existing agreement between the United Mine Workers and the Anthracite Operators of Pennsylvania. This decision was handed down July 7 by Chas. P. Neill, umpire of the board. The decision effects hundreds of employes in the hard coal district and was rendered in the adjudication of a complaint against the Lehigh Coal and Navigation Co.

Open Shop Plan Growing

The number of miners working for the Pittsburgh Coal Co. in the Pittsburgh district in 12 mines at the open shop plan, under the November, 1917, wage scale, passed the 3,000-mark for the first time on July 8, when 3,018 men were reported at work. It is a little more than 10 months since the Pittsburgh Coal Co. started the first non-union mine in the Pittsburgh district, independent of the United Mine working.

The figure used does not count the number of men on the pay roll, which is always considerably larger, but includes only the number of men actually working.

It is estimated that there are about 5,500 non-union miners working in the Pittsburgh district, in a total of 21 mines operated by eight companies.

Miners Re-employed—Strike Ends

An agreement whereby the operating officials of the Powhatan Mining Co., near St. Clairsville, Ohio, have agreed to re-employe 70 miners who were discharged for loading dirty coal has settled the strike which was called by the president of the Ohio Miners Union on July 1. The union committee agreed to stand back of the company in case the miners repeated the offense.

Two Coal Properties Resume Operation Under 1917 Scale

The Montour Collieries Co. and the McClane Mining Co. have resumed operations under the 1917 wage scale. These properties are located in the Pittsburgh district and are two more companies that have joined the movement to re-establish the 1917 wage scale in this territory. This brings the number of operating companies working in this district under the 1917 scale up to eight. It is also reported that the Pittsburgh Coal Co. will open its thirteenth mine some time during July.

Open Shop In Pittsburgh District Gains

According to some coal operators the United Mine Workers of America may cease to be a factor in the bituminous industry in the Pittsburgh district with the expiration of the present wage agreement. It is hardly probable that the Pittsburgh Coal Co., which has been steadily increasing its production on an open-shop basis, will enter into negotiation with the mine workers for a new wage scale. It is not anticipated that other operators who have joined the Pittsburgh Coal operating under the 1917 scale will tie up with the union and forfeit their present gains. The open shop mines in the Pittsburgh district during the week ending April 24 produced 77,706 tons, thereby exceeding the union output for that week. At the present time six operators in this district working under the 1917 scale are mining about 116,000 tons per week, while union production is about 75,000 tons exclusive of steel company and other mines not entering the open market. There are now 5,000 non-union miners compared with 3,000 union workers at work.

National Coal Committees

The following committee appointments have been announced by the National Coal Association: Membership Committee—M. L. Gould, president of the Linton Coal Co., Indianapolis, Ind. (chairman); A. B. Aldridge, president of the Stith Coal Co., Birmingham, Ala.; A. W. Calloway, president of the Davis Coal & Coke Co., Philadelphia, Pa.; L. T. Dee, president of the Superior Rock Springs Coal Co., Ogden, Utah; F. A. Fontyn, vice president of the Ebensburg Coal Co., Philadelphia, Pa.; H. Laviers, general manager of the Northeast Coal Co., Paintsville, Ky.; C. F. Richardson, president of the West Kentucky Coal Co., Sturgis, Ky.; W. J. Sampson, president of the Witch Hazel Coal Co., Youngstown, Ohio; Ezra Van Horn, general manager of the Clarkson Coal Mining Co., Cleveland, Ohio; W. M. Wiley, vice president of the Boone County Coal Corporation, Sharples, W. Va.; George J. L. Wulff, president of the Western Coal and Mining Co., St. Louis, Mo. At least one further appointment is to be made. This committee embraces operators with mines in the states of Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Maryland, Missouri, Ohio, Pennsylvania, West Virginia, and Wyoming.

Tax and Cost Accounting Committee—R. C. Tway, president of the R. C. Tway Coal Co., Louisville, Ky. (chairman); A. W. Thompson, president of the Harwick Coal & Coke Co., Pittsburgh, Pa.; John M. Jamison, president of the Jamison Coal & Coke Co., Greensburg, Pa.; Fred S. McConnell, vice president of the Enos Coal Mining Co., Cleveland, Ohio; C. H. Markham, president

of the Marceline Coal & Mining Co., Kansas City, Mo.; H. C. Marchant, president of the Pinnacle Kemmerer Fuel Co., Denver, Colo.; W. D. Ord, president of the Empire Coal & Coke Co., Landgraff, W. Va.; H. W. Showalter, president of the Continental Coal Co., Fairmont, W. Va.; and W. Paul Zimmerman, president of the Zimmerman Coal Co., Terre Haute, Ind. At least one additional appointment to this committee is to be made. This committee embraces operators with mines in the states of Colorado, Indiana, Kentucky, Missouri, Pennsylvania and West Virginia.

New Copper Association Organized

According to recent announcements a new organization is being completed among copper producers to coordinate export sales embracing 90 percent of the world's copper output. Among the important companies said to be included in the organization are Anaconda Copper Mining Co. and its affiliated organizations, Inspiration and Greene Cananea and its subsidiary, Chile Copper; Phelps Dodge Corporation; Kennecott Copper Corporation, and its subsidiaries, Utah Copper, Braden, Nevada and Mother Lode; Cerro de Pasco; Calumet and Arizona and its subsidiary New Cornelia; Calumet and Hecla; Magma; United Verde Copper; United Verde Extension; Copper Range; American Metal; American Smelting and Refining and Howe Sound Co. It is understood that Union Miniera du Haut Katanga will be the main foreign producer. It is also understood that Mansfeld Mining and Smelting Co. of Germany will be a member, as will be certain metal trading companies. The most important companies that are not members will be the Miami Copper Co. and the Rio Tinto.

Meeting Lake Superior Institute

The 1926 meeting of the Lake Superior Mining Institute will be held September 8-9. On September 8 members of the Institute will meet at Ironwood, Mich., and other Gogebic points, leaving late in the day for Milwaukee, where various plants will be visited.

West Virginia Institute Holds Meeting

At a meeting of the West Virginia Coal Mining Institute, held at Bluefield, W. Va., July 13-14, L. M. Brown, district mine inspector, presented a paper on mine management and its relation to safety and efficiency. H. R. McGee, of the Grasselli Powder Co., presented a paper on development, use and misuse of coal mine explosives. J. E. Jones, Old Ben Coal Corporation, discussed rock dusting, and Clyde A. McDowell, safety director of the Davis Coal and Coke Co., discussed general safety in and about the mines. Wm. Yant presented some observations on mine gases at Horning and Eccles disasters, and a paper was presented by Geo. Richardson on steel and its use in coal mining. The Shamokin Mine of the Pocohontas Fuel Co. was inspected by the delegates.

Institute Holds Summer Meeting

The Illinois Mining Institute held its summer meeting aboard the steamboat "Cape Girardeau" on the Mississippi River, June 24-27. Those present were in full accord that it is only through mechanization of their mines that Illinois operators can hope to compete with Western Kentucky and other non-union fields. The larger part of the time devoted to business on the trip was given over to papers and discussions on the mining and preparation problems encountered in mechanical loading. Coal cleaning also was discussed as was safety practice. A paper was presented covering the geology of the territory between St. Louis and Fort Madison. Stop was made at Keokuk, Iowa, where the giant hydroelectric plant of the Mississippi Power Co. was inspected.

Seventh Annual Meeting, American Petroleum Institute

The Seventh Annual Meeting of the American Petroleum Institute will be held at the Mayo Hotel, Tulsa, Okla., December 7, 8 and 9, 1926.

In preparation for the meeting, members of the Institute's board of directors residing in Oklahoma have formed themselves into a General Committee on Local Arrangements, with E. B. Reeser, Barnsdall Corporation, as chairman. The general committee has designated the following sub-committees:

Entertainment — Chairman, D. E. Buchanan, Chester & Smith Corporation; Automobile Transportation — Chairman, P. M. Miskell, Empire Refineries, Inc.; Hotel Accommodations—Chairman, W. C. Franklin, Tidal Oil Co.; Finance—Chairman, W. G. Skelly, Skelly Oil Co.

This general committee plans, in cooperation with Tulsa hotels, for its subcommittee on hotel accommodations to receive applications for and make assignments of hotel and room accommodations. Request for or inquiry about hotel and room reservations should be addressed to W. C. Franklin, Chairman, Committee on Hotel Accommodations, Room 504, Cosden Building Tulsa, Okla.

Committee to Study Stream Pollution

A Committee of the National Coal Association has been appointed to make a nation-wide survey of the subject of stream pollution. The following members comprise this committee:

T. W. Guthrie, president of the Hillman Coal & Coke Co., Pittsburgh, Pa. (chairman); W. H. Cunningham, vice president, Basic Coal Co., Huntington, W. Va.; Irvin Davis, treasurer, Hatfield Reliance Coal Co., Cincinnati, Ohio; H. N. Eavenson, president, Sullivan Pocahontas Coal Co., Pittsburgh, Pa.; Geo. H. Francis, secretary, Keystone Coal & Coke Co., Greensburg, Pa.; John H. Jones, president, Bertha-Consumers Co., Pittsburgh, Pa.; W. L. Robison, vice president, Youghiogheny & Ohio Coal Co., Cleveland, Ohio.

Illinois Mining Institute Meeting

The Illinois State Mining Institute will hold its semi-annual meeting in November, at Harrisburg, Ill., when mine operators and inspectors will get together to exchange ideas and discuss conditions in all fields. T. E. Coulehan is chairman of the program committee, and he will be assisted by R. E. McCleish, J. C. Kendall of the Saline County Coal Corp., State Mine Inspector Thomas English, Lee Haskins, general manager of the Dering Coal Co., George Haskins, superintendent of mines of that company, and Paul Haberslaven, of the O'Gara Coal Co.

Prize Awarded

A cash prize of $100 was offered for the best paper submitted during Oil and Gas Power National Conference, April 19-24, 1926.

The Steering Committee has announced that it has been decided to award this prize to Mr. Fred Thilenius, Assistant Master Mechanic, Prairie Pipe Line Co., Tulsa, Okla., for his paper on "Oil Engines as a Drive for Pipe-Line Pumps," presented at the April 22 meeting of the A. S. M. E. Mid-Continent Section.

If there is no objection and if it suits Mr. Thilenius' convenience, this prize will be presented to him at the 1926 Annual Meeting of The American Society of Mechanical Engineers in December, Oil and Gas Power Session, New York. N. Y.

Safety Service Appointment

Daniel Harrington, Consulting Engineer, Salt Lake City, Utah, has been appointed as Chief Engineer of the Safety Service of the United States Bureau of Mines, by Director Scott Turner, effective August 1. Safety and Health will be a new department of the Bureau, and will be under the supervision of Dr. R. R. Sayers, who is Chief Surgeon of the Bureau.

LEGISLATIVE REVIEW

Congress Session Ends—Important Measures Enacted in Past Seven Months — Uncompleted Bills Hold Over Until December Session—Potash Explorations Authorized, But Silver Purchase and War Mineral Bills Still Pending

AFTER a steady grind of seven months, beginning in December and terminating on July 3, the first session of the Sixty-ninth Congress came to a finish by the enactment of important legislative proposals. In many respects the session which has just passed into history was the most active from a strictly business standpoint and free from any spectacular features that has been held by Congress in many years. Beginning with tax revision and reduction at the very start in December, both House and Senate gave the greatest attention to many constructive legislative proposals. Quite a number of these passed through all the legislative stages, while a few others were either completed by committee consideration or are pending on the Senate and House calendars for action when Congress resumes its labors next December.

One of the most important enactments in the closing days of the session, from the standpoint of the mining industry, was the bill to authorize a five-year program of investigations to determine the location and character of potash deposits. An appropriation of $100,000 for the first year's work was made, which will permit of drilling operations in Texas as a start on this important program.

Although both measures were passed by the Senate, the silver purchase bill and the war mineral relief measure did not emerge from the House committees to which they were referred. These measures are expected to receive consideration in the House at the next session.

An eleventh hour effort to have an investigation made of the copper industry with a view of developing data as a basis for an import duty on copper failed. A bill which was passed by the House to authorize nonmetalliferous mineral leases on western Indian lands came over to the Senate too late for action at the recent session.

While proposed coal legislation was the storm center of almost continuous debate in both Senate and House, the session ended without any action on the measures to set up a fact-finding agency for this industry. A bill had been reported by a Senate committee but its author was unable to secure its consideration, while in the House committee there were not sufficient votes to report out a coal control bill.

Another legislative proposal to go over until the December session was the matter of the lease of the Muscle Shoals, Ala., nitrate and power project.

A mining bill suffered a presidential veto, the President returning without approval a bill which had been passed to authorize oil and gas mining leases on unallotted lands in Executive order Indian reservations.

A law was enacted to define and punish trespasses on public coal lands under Government ownership.

While legislation designed to prevent pollution of streams by oil or mine drainage received a sharp blow in the form of a War Department report advising caution in the matter, another bill was introduced to apply antipollution legislation to interstate sources and injury by pollution.

The increasing disinclination of Congress to carry on various investigations was again manifested when a Senate committee turned down a proposal to investigate conditions in the aluminum and steel industries.

Agitation for reduction of the corporation tax has arisen in Congress and seven bills were introduced prior to adjournment of the session to accomplish this end. Congressional leaders, however, frown on tax revision at the next session.

Laws were enacted to establish forest experiment stations in Pennsylvania and the Ohio and Mississippi Valleys. The mining industry will be able to secure new sources of mine timber as a result of prospective work of these stations in forest preservation and treatment.

Two constructive inquiries have been initiated by Congress. One provides for development of a merchant marine policy by the Shipping Board and the other calls for an inquiry into administration of enemy alien property taken during the war with a view to returning this property to the owners.

Potash Explorations

S. 1821. Enacted into law. This law authorizes explorations for and laboratory tests of potash by the Bureau of Mines and Geological Survey under an annual appropriation of $100,000 yearly for each of the five years beginning July 1, 1926.

S. Res. 259. Introduced by Mr. Cameron (Rep., Ariz.). Referred to the Committee on Contingent Expenses. This resolution proposed the appointment of a committee of five Senators to "investigate the copper industry in the United States in all of its aspects, including production and distribution of copper, and corporate organization in such industry." The purpose of the investigation was to gather data in support of a duty of 6 cents per pound on imported copper.

H. R. 12393. Passed by the House and reported by the Senate Indian Committee. This bill proposes to authorize metalliferous and nonmetalliferous mining leases, including gold, silver, and copper, on unallotted lands in Indian reservations in Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Washington, and Wyoming.

Mine Leases

S. 4261. Enacted into law. This law authorizes leases by the Interior Department of gold, silver, or quicksilver on lands whose mineral contents were not conveyed to patentees under decrees of the court of private land claims. Those receiving leases would pay the Government from 5 to 12½ percent of the net value of the mineral output.

S. 3963. Passed by the Senate. This bill establishes grazing districts in Alaska, but stipulates that the use of the land for this purpose shall be subordinated to the development of the mineral resources.

Coal Lands

H. R. 7371. Enacted into law. This law defines and punishes unlawful trespass on Government coal lands.

S. 4152. Passed by Congress but vetoed by the President. This bill authorized oil and gas mining leases on unallotted lands in Executive order Indian reservations. The President's objection to the legislation was based on the fact that it would validate 20 prior permits for mining operations and deny 400 pending applications for such permits.

H. R. 13249. Introduced by Mr. Hayden (Dem., Ariz.). Referred to the Committee on Indian Affairs. This is similar to the foregoing.

H. R. 10980. Enacted into law. This law authorizes the issuance of oil and gas leases in Carbon County, Wyo., to M. D. Woolery and others, in place of their placer-mining locations.

Stream Pollution

H. R. 13142. Introduced by Mr. Wilson (Dem., La.). Referred to the Committee on Rivers and Harbors. This bill authorizes the War Department to issue regulations to prevent the pollution of navigable rivers by oil from wells, terminals,

refineries, tanks, or storage places. The regulations would not apply to pollution whose source and injury is in a single state.

S. 4054. Passed by the Senate. This bill extends the mineral leasing law to the Zuni district of the Manzano National Forest, formerly the Fort Wingate Military Reservation, in New Mexico.

S. J. Res. 46. Enacted into law. This law provides that receipts, including those from mineral leases, from school land grants to New Mexico shall be equally divided among the educational institutions of the state.

Land Titles

S. 4055. Enacted into law. This law authorizes the Interior Department to issue patents to 160-acre tracts of land in New Mexico which have been held under color of title for more than 20 years.

S. Res. 177. Adversely reported by the Committee on Labor. This resolution proposed an investigation of conditions in the aluminum and steel industries.

H. R. 12951. Introduced by Mr. Almon (Dem., Ala.). Referred to the Military Committee. This bill proposes to lease the Muscle Shoals, Ala., nitrate and power project to the Air Nitrate Corporation and the American Cyanamid Co.

H. R. 5866. Passed by the House. This bill authorizes the Lehigh Coal & Navigation Co. to sue the Government in the eastern district of Pennsylvania court for damages to one of its vessels by a collision of a Government vessel in the Schuylkill River in March, 1920.

Labor Safety

H. R. 12263. Reported by the Committee on Labor. This bill proposes to create a division of labor safety in the Department of Labor.

S. Res. 207. Reported by the Committee on Interstate Commerce. This resolution provided for an investigation of a strike on the Western Maryland Railroad, a coal carrier. The committee recommended that the matter be considered by the new Railroad Labor Mediation Board.

H. R. 12953. Introduced by Mr. Allgood (Dem., Ala.). Referred to the Committee on Interstate Commerce. This bill proposes that the Interstate Commerce Commission shall consist of 13 members, appointed from districts of the country as follows: New England and Pacific States, one member each; Middle Atlantic, South Atlantic, Gulf, and Mountain States, each two members; and Lake States, three members.

S. 2320. Passed by the Senate and reported by the House Committee on Interstate Commerce. This bill provides regulations to safeguard the distribution and sale of dangerous caustic or corrosive acids and alkalies.

IMPORTANT BILLS REVIEWED IN THIS ISSUE

Mining

S. 1821—Enacted into law. Potash explorations.
S. Res. 259—Cameron (Rep., Ariz.) Copper inquiry.
H. R. 12393—Arentz (Rep., Nev.). Nonmetalliferous mining leases.
S. 4261—Enacted into law. Gold and silver leases.
H. R. 7371—Enacted into law. Coal land trespass.
S. 4152—Vetoed by President. Oil and gas leases.

Industrial

H. R. 13142—Wilson (Dem., La.). Stream pollution.
S. Res. 177—Adversely reported. Aluminum and steel inquiry.
H. R. 12951—Almon (Dem., Ala.). Muscle Shoals lease.
H. R. 12263—Reported by committee. Labor safety division.

Revenue

H. R. 13014—Crisp (Dem., Ga.). Corporation tax reduction.

Miscellaneous

S. 2516—Enacted into law. Pennsylvania forest station.
S. 3405—Enacted into law. Ohio forest station.
S. Res. 71—Passed by Senate. Alien property inquiry.
S. Res. 262—Passed by Senate. Merchant marine policy.

Tax Reduction

H. R. 13014. Introduced by Mr. Crisp (Dem., Ga.). Referred to the Committee on Ways and Means. This bill proposes to reduce the corporation tax to 10 percent.

H. R. 13013. Introduced by Mr. Jacobstein (Dem., N. Y.). Referred to the Committee on Ways and Means. This bill directs the congressional tax investigating committee to investigate and recommend to the House Ways and Means Committee before November 1 the reduction of taxes on corporations.

S. 4506. Introduced by Mr. Copeland (Dem., N. Y.). Referred to the Finance Committee. This is similar to the foregoing.

H. R. 13042. Introduced by Mr. Rainey (Dem., Ill.). Referred to the Committee on Ways and Means. This bill proposes to repeal the stamp and excise taxes.

Forest Stations

S. 2516. Enacted into law. This law authorizes the establishment of a forest experiment station in Pennsylvania and neighboring states, for cooperation between New Jersey, part of Ohio, Maryland, and Delaware.

S. 3405. Enacted into law. This law authorizes the establishment of a forest experiment station in the Ohio and Mississippi Valleys.

S. Res. 71. Passed by the Senate. This resolution authorizes an investigation of the administration of the office of the Alien Property Custodian, including the sale of chemical patents to the Chemical Foundation. This investigating committee consists of Senators Borah (Rep., Idaho), Metcalf (Rep., R. I.), McMaster (Rep., S. Dak.), Bratton (Dem., N. Mex.), and Stephens (Dem., Miss.).

S. Res. 262. Introduced by Mr. Jones (Rep., Wash.). Passed by the Senate. This resolution requests the Shipping Board to investigate and report January 1 on plans for building up and maintaining a merchant marine for commerce and national security through private capital under private ownership, and through construction, operation, and ownership by the Government.

H. R. 9690. Enacted into law. This law authorizes a five-year naval airplane construction program, including a $300,000 experimental metal-clad airplane.

S. 3928. Passed by the Senate and reported by the House Committee on Territories. This bill authorizes the appointment of commissioners for each of the executive departments handling Alaskan affairs.

H. J. Res. 288. Introduced by Mr. Weller (Dem., N. Y.), by request. Referred to the Committee on Rules. This resolution proposes to assure peace by eliminating completely all profit during war.

Accidents at coal mines in the United States in June were responsible for the loss of 145 lives, according to information received from State mine inspectors by the Bureau of Mines. Of this number 105 deaths occurred in the bituminous mines and 40 in anthracite mines. Based on a production of 41,992,000 tons of bituminous coal and 8,937,000 tons of anthracite, the fatality rates per million tons of coal produced were 2.50 and 4.48 respectively, while for the industry as a whole the rate was 2.85.

No major disaster—that is, one causing the death of five or more men—was reported for the month of June, but such disasters for 1926 to date have numbered eight and have caused the loss of 195 lives. For the same period in 1925 there were eight major accidents causing the death of 179 men.

THE NATION'S VIEWPOINT

A Digest Of The Expressed Opinions Of Leaders In American Affairs

THE changing public attitude in regard to the Sherman Anti-Trust Law is subject for editorial comment in the *Democrat Chronicle*, of Rochester, N. Y., which says:

"We feel our way in America from theory to theory of how things should be run. Our anti-trust laws grew out of the feeling that huge industrial combinations were designed and effected to enrich a few at the expense of the many from whom unconscionable prices would be extorted. But that conclusion is coming to be negatived by facts and has been disproved so far that the MINING CONGRESS JOURNAL does not hesitate to say that the public begins to realize that the greatest relief from high prices will come through business combinations and consolidations, reducing overhead, and costs of distribution and eliminating waste of economic effort.

"Representative Manlove, of Missouri, argues with force that extensive consolidations of coal interests under Government supervision would stabilize that industry to the advantage alike of producer, miner and the public; for it would tend to insure the continuous operation of low-cost mines and steady employment for labor. That seems a reasonable conclusion, and Britain's present perplexities add force to it. Combinations of interest or agreement between British operators would enable them to mine by the latest and most effective methods, by machinery instead of by man-power as now. Machinery cuts the cost of production of whatever kind; and it is common knowledge in America that those of our great industries which are mechanized to the last degree are the ones of largest output and lowest prices to the public. The two industries with which the names of the two richest Americans are associated in the popular mind are outstanding instances of how gigantic production permits economies which keep cost to consumers at the lowest point.

"The word 'trust' in economics has been in bad odor for several decades until people came to consider such combinations as hostile, remorseless extortioners, to be combatted in every way. But that view is being modified. It becomes apparent that a regulated consolidation of interests—railroads for example—are a good thing for the country. So also powerful sectional combinations of food producers in cooperative distribution and marketing would be a splendid thing for farmers and for consumers alike."

Wallace Press-Times

Tireless

The *American Economist* prints some interesting figures in connection with the Imports and Exports of this Country, under the Protective Tariff system:

"During the 12 months ending with September, 1922, the value of our imports was $2,817,768,600, and during the 12 months ending with May, this year, the value of our imports reached $4,452,022,000—an increase, not a decrease, of $1,634,253,400, or 58 percent. That was what our Protective Tariff has done for our imports.

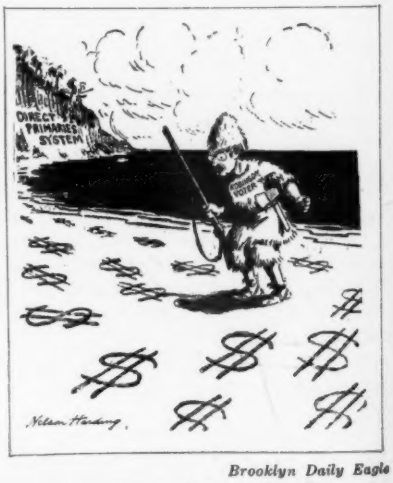
"During the 12 months ending with September, 1922, the value of our exports (under the Underwood near Free-Trade Tariff Act), totaled $3,670,401,433, and during the 12 months ending with May, this year, the value of our exports (under the existing Protective Tariff Act) totaled $4,738,222,000, an increase of $1,067,820,587, or 29 percent. That is what the Protective Tariff did for our exports.

"The total value of the foreign commerce of the United States—imports and exports—for the 12 months ending with May, this year, under a Protective Tariff, was $9,190,244,000; and the total value of our imports and exports during the 12 months ending with September, 1922 (under the Underwood near Free-Trade Tariff), was $6,488,169,033, or an increase in our foreign trade under protection of $2,702,075,967, or 41.64 percent. Under the circumstances, and in the light of the foregoing, what are the predictions of Free-Traders and internationalists worth?"

Iron Trade Review in commenting upon the recent statement of H. L. Gandy, Secretary, National Coal Association, at the annual meeting of this organization at Chicago, says:

"Discussing coal legislation proposed at the current session of Congress, Harry L. Gandy said:

" 'England has had fact-finding about bituminous coal for many years. Governmental agencies have there dabbled in wage conferences. The record here and in England justifies the statement that the advance recognition of an industrial emer-



Brooklyn Daily Eagle

Signs of Intruders

Wallace Press-Times

Otherwise It's a Fair Catch

gency will bring the emergency. The setting up of a body political to which either side of an industrial controversy may appeal will make practically certain that employers and employes cannot agree.'

"This observation should provoke considerable discussion. On the point that anticipation insures realization a position pro and con can be maintained. The person contending that crime is stimulated by the wide publicity given it would not be likely to advocate the abolition of police departments. It can be proved with equal facility that war has been provoked both by the presence and by the absence of standing armies. Considering fact-finding in an abstract manner, nothing would be more disturbing to the steel industry than to have Congress assume that something was wrong with it and set up a commission to rummage about.

"However, the conditions surrounding the coal industry are so peculiar to the industry that generalizations are questionable. More than any other industry, coal is charged with a public interest; it is the key to most industrial processes. All of the anthracite and a large portion of the bituminous coal industries have been saddled with unionism and a labor hierarchy that are a constant threat to the peace of the industry. The prospect of stoppage recurs so frequently that the nation is thoroughly convinced of the necessity for self-protection.

"The fact that regulatory legislation concerning no other industry than coal has been considered at this session of Congress is eloquent. Individually the producers of other commodities can sympathize with the producers of coal, but considering coal as the basis of practically all industrial operations and recollecting the periodic disturbance it brings, the feeling of apprehension is understandable."

The action of the Ohio Coal Operators in forming the Ohio Coal Operators Association, brings forth the following comment from the *Black Diamond:*

"After two years struggle against the overwhelming odds which the Jacksonville agreement gave to their market competitors; after their various district organizations had fought in vain to protect their interests; and after they had seen their business dwindle to the point that only 25 percent of the normal tonnage of the state was being produced, the coal mine operators of Ohio this week organized in a single unit to force a show-down with the United Mine Workers. The meeting of mine operators, from every district in the state, which was held in Columbus, effected a permanent organization and passed resolutions declaring the association charged with the duty of developing a broad policy respecting the employment of labor in the mines of the state, giving due consideration to the rights of both employer and the men employed, to the end that the industry be placed upon a basis which will permit of the early and general resumption of successful operation of their mines in the competition which they encounter in marketing their coal.

"Although there was no open statement of intention to demand a reduction of the wage scale established by the Jacksonville agreement, there is no doubt that such is the determination of the harassed Ohio operators. Their embarrassment has reached the point where it is imperative to obtain a reduction of the wage scale to at least the 1917 level, with or without the consent of the union, or to definitely close their mines and forfeit their investments and means of livelihood. It is apparent that an effort will be made to obtain the consent of the union to the reduction, failing which the mining industry of the State of Ohio will be placed on an open shop basis. If the union replies to this decision with a strike, the situation in its essential character will be scarcely changed. No strike could close down mining operations in Ohio much more effectively than they are at present.

"The Ohio Operators' Association, Inc., has been organized to perform in that state what already has been done in West Virginia, Pennsylvania, Kentucky, Alabama and several of the lesser producing sections of the country—that is, to give the mercy blow to the badly functioning miners' union, and to start the coal industry in that region on the road to sane and healthful recovery.

N. Y. Evening Post

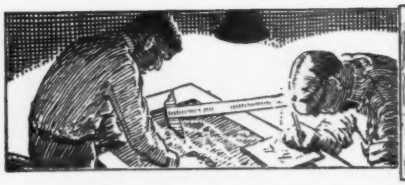
So He Obeyed That Impulse

Wallace Press-Times

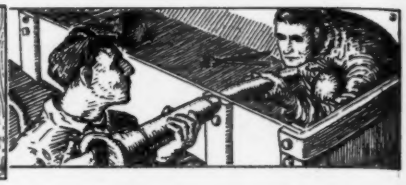
A Swell Trip

Wallace Press-Times

Everybody's Happy



WITH THE MANUFACTURERS



Turbine Designed for Different Operating Conditions

A steam turbine which can be used with relatively low steam pressure and temperature in a present station, but which with slight changes can be used with steam of high pressure and temperature when the station is modernized, is being obtained by the Trinidad Electric Transmission, Railway and Gas Co. of Trinidad, Colo., which supplies power to most of the coal mines in the southern Colorado fields around Walsenburg and Trinidad.

In the Trinidad plant there is a 5,000-kw. steam turbine generator set; the Walsenburg plant is at present of smaller capacity. The power demand made it necessary to add to the equipment of the Walsenburg station, which is an old plant with low steam pressure and superheat. The company is looking forward to the day when it will put in new boilers, raising the steam pressure and temperature to a point which will give the economy of a modern plant. Inquiry was therefore made for a machine which could be used at present on 165 pounds steam pressure and 100 degrees superheat, and which with minimum modification can at a later date be used on a pressure of 350 pounds or more and a total steam temperature of 700 degrees F.

A 6,000-kw. steam turbine meeting these specifications was designed by the engineers at the Lynn works of the General Electric Co., and is now being built there. The unit is laid out with all high pressure parts suitable for the maximum steam temperature and pressure, and provision is made for eventually mounting 14 wheels; but as first installed for the lower steam pressure it will have nine wheels, and the first-stage nozzle and buckets will be suitable for the lower pressure. The five wheels originally omitted, together with high pressure nozzles, will be shipped along with the turbine.

When the plant is rebuilt for 350-pound steam pressure it will merely be necessary to place the extra five wheels and high pressure nozzles in the turbine.

In this way the Trinidad company will secure the benefits of maximum economy of operation under both present and future steam conditions.

In line with modern practice the turbine will be arranged for steam extraction at two pressure for feed-water heating.

An Improved Type of Jeffrey Portable Conveyor

The Jeffrey Manufacturing Company, of Columbus, Ohio, has recently put on the market an improved type of Portable Belt Conveyor for handling Sand, Gravel, Crushed Stone, Bricks, Tile, Boxes, Coal, Coke and similar materials.

The improvements are designed around the idea of providing a machine more suitable for road construction service, building material yards, and industrial plants where it is desired to handle materials from hopper bottom railroad cars to storage piles or trucks, and for

reclaiming from storage piles.

The new features consist of four important developments:

1. Steel side boards which are bent to extend under the side of the belt forming with belt a moving trough which provides larger capacity and prevents lumps from rolling off.

2. An improved type of carrying idler to support the loaded portion of the belt.

3. An extended and flared loading leg at the bottom, edged with belting material to form a seal with the moving belt. The flared hopper also centers the load on the conveyor.

4. An efficient gate at the foot of the conveyor to prevent material from falling into the enclosed boot housing.

In addition to these recent improvements attention is directed to several other important features of the Jeffrey design, as follows:

1. Built in 18, 24 and 30 foot lengths, and is furnished with electric motor or gasoline engine.

2. A reliable and easily operated screw adjusts the elevator to any convenient height. Different holes in the pipe struts allow wheels to be adjusted forward or backward to balance the load.

3. Foot of conveyor is low so that it will readily enter a pile of loose material. Foot pulley has efficient aligning screws to bring belt in center.

4. Belt furnished is 16-inch rubber covered troughs. A one-piece cast iron idler. Return idlers form an efficient belt-cleaning device.

5. Loading leg bunches up material in center of belt and avoids side spill.

6. Steel flights attached to center of belt to increase carrying capacity on machine, keep small round particles from rolling down the belt, and are so arranged that they cannot catch on material and tear the belt.

Explosion-Proof Motor and Control Provides Safety in Operation

The Westinghouse Electric & Manufacturing Co. announces the development of an explosion-proof direct-current motor and control, designed primarily for service in coal mines, in which the presence of large quantities of gas or coal dust makes the use of electrical equipment of special construction essential to safe operation. While designed particularly for small pumps, the motor which develops 5 horsepower at 1,150 revolutions per minute, can be used in a number of other applications.

This motor is of the totally enclosed type, the brackets being provided with covers which can be easily removed to facilitate inspection and brush adjustments or replacements. These covers are also arranged so that they may be sealed to the brackets in order to prevent removal by unauthorized persons. All connections between the motor leads and the power supply are made inside of the motor frame. The conductor cable is brought out through a special brass stuffing box which is packed with asbestos twine, forming a perfect explosion-proof seal, and also affording protection to the cable.

The controller is of the magnetic push-button type, enclosed in a strong explosion-proof case made in two sections. The panel on which the contactor is mounted is firmly fastened to the lower section, and the upper section fits over this panel and is fastened to the base by means of a bronze clamping ring. This method of construction eliminates en-

tirely the use of bolts or screws, which have proven so objectionable in the design of "permissible" equipment.

This 5 horsepower motor and control has been developed to meet the United States Bureau of Mines requirements for electrical equipment designed for use in gaseous mines, and has successfully passed their tests.

Bureau of Mines Approves Myers-Whaley Shoveling Machine Equipment

The Myers-Whaley Co., Inc., Knoxville, Tenn., has been granted Bureau of Mines Approval No. 127, July 16, 1926, covering permissible motor equipment for their No. 4 and Special No. 3 size shoveling and loading machines for use in gaseous and dusty mines. This is said to be the first approval of this particular type of motor equipment to be given by the Bureau.

The permissible outfit consists of a reel for 250 to 400 ft. of Super Service Duplex Mining Machine Cable; motor; control box; headlight, and connections for the above.

The reel has contact housings at each end, from which the two line wires are carried in flexible metallic tubing to the lead entrances to the control case.

The motor selected for this outfit is similar to the one that has been used for many years on one of the well known coal cutting machines. It is built by the General Electric Co. and is of the protected ventilating type—30 H. P. on one hour rating, which gives it ample power for the 15 to 20 H. P. continuous rating required on Myers-Whaley machines. The drive from motor to first shaft of machine is through a triple roller chain operating in a closed chain case.

The control box is a steel casting with walls ¾-inch thick, and contains a two-pole multiple fuse drum switch, a Post Glover Homanite steel grid resistance for starting duty, and a nonreversing five-point drum controller. The controller drum is operated from the operator's platform by a Myers-Whaley oil control.

The headlight is a Westinghouse Type S mine locomotive headlight, mounted on the jib.

All wires between compartments are of the heavy rubber type, carried in bronze flexible tubing and entrances to cases are of approved construction.

Mr. Charles J. Murray has recently resigned from staff of The Linde Air Products Co., to become associated with the Oklahoma Contracting Co. He is now organizing a new division of that concern to engage exclusively in oxwelded pipe line construction. During his association with the Linde Co., Mr. Murray specialized in this class of work and has studied the construction problems connected with a large number of notable trunk line projects.

Roberts and Schaefer Purchase Car Dumper and Equipment Co.

On July 15, 1926, we will take over the manufacture and sale of rotary car dumpers, car feeders, car controls, and all other equipment previously manufactured and sold by the Car-Dumper & Equipment Co. of Chicago. We will at that time assume all uncompleted contracts and complete them in accordance with the original plans and specifications.

The manufacture and sale of all equipment heretofore sold by the Car-Dumper & Equipment Co. will be handled for us in a department to be headed by Mr. George N. Simpson, president of the Car-Dumper & Equipment Co.

We have taken over all patents, drawings, patterns, etc., of the Car-Dumper & Equipment Co. and will, therefore, be prepared to furnish all necessary repair parts for any equipment previously sold by this company, orders for which should be addressed to us to receive prompt attention.

We expect to carry on the business of manufacturing and selling car dumpers, car feeders, car controls, and all other equipment of this nature on an even larger scale than has been done by the Car-Dumper & Equipment Co., and shall endeavor to apply our customary policy of improvements in this equipment to maintain its present high reputation.

We shall appreciate the support of all former clients of the Car-Dumper & Equipment Co., and hope to secure many new ones.

As with our other departments, so shall our slogan be with our car-dumper department: "Fulfill the Contract—Satisfy the Client."

ROBERTS & SCHAEFER CO.
EDWARD E. BARRETT,
President.

General Electric Orders for Six Months of 1926

Orders received by the General Electric Co. for the first six months of 1926 totaled $165,405,720, representing an increase of 10 percent over the $150,315,228 booked in the corresponding six months of 1925, President Gerard Swope has announced.

For the three months ending June 30 this year, orders totaled $78,972,062, compared with $66,468,992 for the second quarter of 1925, an increase of 19 percent.

In the first six months of this year there were 152 working days, including Saturdays, showing General Electric orders received thus far this year have been at a rate of better than $1,000,000 per day.

General Electric to Report Earnings Quarterly—Change in Dividend Date

The General Electric Co. will report earnings quarterly to its stockholders, President Gerard Swope has announced. It is believed that this company will be the first corporation to make such reports. The announcement, made in the letter accompanying the report for the quarter ending June 30, reads as follows:

"With the object of keeping stockholders informed, quarterly statements of orders received have been sent you with dividend checks for several years.

"For a long time your officers have been developing plans for reporting earnings quarterly to stockholders. A statement of the earnings of your company for the half year ending June 30, 1926, which could not be prepared in time to send herewith, will be published before the end of this month. To carry out the plan of sending quarterly statements to each stockholder with the dividends, it will be necessary to change the dividend date from the 15th to about the 25th of the month, and your next quarterly dividend will accordingly be payable on or about October 25, 1926, and will be accompanied by a statement of orders received and earnings for the first nine months of this year."

New Jeffrey Officials

The Jeffrey Manufacturing Co., of Columbus, Ohio, announces the election of Robert W. Gillispie as vice-president, assistant general manager, and member of the board of directors.

Mr. Gillispie has for many years been identified with the Bethlehem Steel Co. and is a prominent and outstanding figure in the executive sales work of that company. He was graduated from Wesleyan University, Connecticut, in the class of 1904, with Phi Beta Kappa rank, was an athlete and captain of the varsity football team.

He is regarded as a man of exceptional talent and force.

The Jeffrey Manufacturing Co. is well known as the oldest and largest manufacturer of coal mining machinery in the United States and makes not only coal-cutting machinery, locomotives, and other mine equipment, including coal tipples, but is extensively engaged in broad engineering installations and in the manufacture of unit machinery for material handling in numerous lines.

Through the variety of its output it has been associated with practically all branches of basic industry and has a large foreign as well as domestic market.

Mr. Gillispie goes to the Jeffrey Company equipped with ripe experience in manufacturing and selling and should prove an effective addition to the company's staff.

Link-Belt Company Hold Drive Chain Conference

For the sixteenth time in 20 years, the first conference taking place in 1906, just six years after they introduced Silent Chain to the American public as a power transmitter, the Link-Belt Co. of Chicago, Indianapolis and Philadelphia held their Drive Chain Conference, this year at Indianapolis, July 7, 8 and 9.

This conference, held at the Dodge Works, "The Home of Silent Chain," and presided over by Mr. James S. Watson, General Manager of the Dodge Plant, and of the Drive Chain Division, was unique in its modernness in many respects.

T. E. Doremus, at present manager of the Seattle, Wash., office of the Explosives Department of E. I. du Pont de Nemours & Co., has been appointed manager of the New York office of the Explosives Department, succeeding the late Frederick C. Peters. He will assume his new duties August 1.

Mr. Doremus is well known in the explosives industry. He began his work in the industry as a boy with the Schaghticake Powder Co., which was a subsidiary of the du Pont Co. He made rapid progress with this company, becoming assistant secretary. Later he joined the Laflin & Rand Powder Co. and then came with the du Pont Co. in a clerical capacity. He served a number of years as assistant manager and manager of the Sporting Powder Division.

When the Dyes Department organized its foreign sales department, he became its representative in China and put this branch of the industry on a working basis, gaining for himself valuable experience in the export trade. He was recalled from China to take charge of the Seattle office where he has done important work both domestic and foreign.

Mr. Doremus has been closely identified during all of his business life with civic affairs and has taken an important part in the activities of many business and civic associations.

Change in Management, Boston Office, the Cutler-Hammer Mfg. Co.

B. M. Horter, formerly of the Philadelphia office of the Cutler-Hammer Mfg. Co., has just been appointed manager of the company's Boston office. He succeeds J. M. Fernald, who has resigned to enter a different field of business.

Mr. Horter has been with the Cutler-Hammer Mfg. Co. since March, 1916. At one time Mr. Horter was manager of the Wilkes-Barre office of Cutler-Hammer, which has since been discontinued. During the war he served on a submarine chaser. His technical ability makes him particularly fitted for the important post which he assumes July 1.

The Triumph Electric Corporation has been organized to take over the good will, designs, records, patent rights and inventions of The Triumph Electric Co.

So far as practical the new company will retain the old personnel and Triumph customers are promised prompt service on existing installations and the same high quality in new product for which the old company was so well known.

The new company will specialize on its TR self start automatic heavy duty motor and at the same time be in a position to supply its other lines of electrical and refrigerating products.

Supplying only high quality product and service, it expects to deserve the continued support of Triumph customers and friends.

New Electrical Publication

"Industry's Electrical Progress" is the title of a very interesting publication issued by the Cutler-Hammer Mfg. Co., pioneer manufacturers of electric control apparatus, Milwaukee, Wis.

The author starts out to prove that the competitive advantages which electric power brings to industry lies in the effectiveness with which electricity is utilized. He does a good job of it and has produced a book which any business man connected with a manufacturing company should read.

After showing that the consumption of electricity for industrial purposes has increased 3,000 percent since 1905, and almost doubled since 1921, the book points out the progress which has likewise been made in electrical equipment, particularly in motors and motor control apparatus. Then it gives numerous examples of the wondrous accomplishments of correct motor control equipment. Many photographs of actual installations are shown.

The Cutler-Hammer Mfg. Co. offer to send a free copy to anyone requesting it on their letterhead. The address is 178 Twelfth Street.

Hercules Powder Co. has just issued a blasters' scale. The scale will be convenient and helpful to anyone in charge of blasting operations where well drilled holes are used. Free copies of these scales may be obtained from the Hercules Powder Co., Wilmington, Dela.

Publication on Westinghouse Shovel-Type Transformers

L. 20288, a descriptive leaflet on the new shovel-type transformers designed and manufactured by the Westinghouse Electric and Manufacturing Co. has just been released. This four page publication describes well the application, construction and distinctive features of this transformer, which is designed with leak-proof bushings and tank. Several halftone illustrations and a tabulation of outline dimensions complete this leaflet, which is available at all the district offices of the Westinghouse Co., and at the publicity department at East Pittsburgh, Pa.

Bulletin 108 describing the Poole all metal flexible coupling has been issued by Poole Engineering & Machine Co., Baltimore, Md.

The Keystone Lubricating Co. has issued a 48-page booklet, "The Keystone Safety Lubricator; Questions Answered and Typical Installations Illustrated." As its title implies, it is a thorough discussion of the lubricator, its purpose, method of operation, relation to safety, adaptability, etc. Various types of installation are discussed and illustrated, together with the accessories that have been designed to reduce the time of lubrication attention as close as possible to zero.

The close relation of lubrication to safety and to overhead costs brought about the development of the Keystone Safety Lubricator, and the booklet is built up around this much neglected branch of engineering practice. It has just come from the press and is available to any executive or operating man who is interested in safety and efficiency. Copies may be obtained from the Keystone Lubricating Co., 21st and Clearfield Streets, Philadelphia, Pa.

Bulletin No. 83-C, describing Sullivan gas compressors of several types, has just been issued by the Sullivan Machinery Co. It finds an increasing interest in gas compression for securing proper combustion under industrial furnaces for a wide range of purposes. For example, brick plants are substituting city gas for fuel instead of wood. Manufacturing concerns are using gas-fired furnace equipment for tempering, annealing, baking, and many other tasks. In addition, the compressors described in this catalog are frequently used for compressing gas for transmission for high-pressure district holder service, etc., to obviate increasing the size of distribution lines and for transmitting the gas over considerable distances from one town to another.

New G-E Catalogs

Among the new catalogs recently issued by the General Electric Co. are: GEA-405, on Constant Speed Induction Motors for Elevator Service; GEA-435, on Multi-Speed Induction Motors for Elevator Service; GEA-372, on Explosion Chambers for High-Voltage Oil Circuit Breakers; GEA-19b, on Enclosed Magnetic Switches; and GEA-416, on Automatic Starting Compensators.

ADMIRALTY
New River Smokeless

Admiralty Coal
New River Smokeless

Prepared over Shaker Screens and Loading Booms
Highest Standards of Preparation
LUMP EGG NUT

DEPENDABLE COAL
Anthracite

BUNKER COAL
SUPPLIED AT
BALTIMORE, MD.
CHARLESTON, S. C.
HAMPTON ROADS, VA.
JACKSONVILLE, FLA.
NEW YORK
PHILADELPHIA
SAVANNAH, GA.

GENERAL COAL COMPANY
PHILADELPHIA
BOSTON CHARLESTON CHARLOTTE CINCINNATI
DETROIT NEW YORK NORFOLK PITTSBURGH

EXPORT AND COASTWISE COAL
LOADED AT
BALTIMORE, MD.
CHARLESTON, S. C.
HAMPTON ROADS, VA.
NEW YORK
PHILADELPHIA

THORNE, NEALE & COMPANY., Inc.
FRANKLIN BANK BUILDING
1416 CHESTNUT STREET—9 A. M. to 4 P. M.
PHILADELPHIA, PA.

MINERS' AGENTS AND WHOLESALE DEALERS

Anthracite **COAL** ***Bituminous***

ANTHRACITE COLLIERIES

Mt. Lookout, Sterrick Creek, Harry E, Northwest, Forty Fort, Lackawanna, New Castle, Buck Run, Locust Run (Washery)

Pardee Bros. & Co.—Lattimer Lehigh

BITUMINOUS

Sonman, South Fork District—Low volatile, low ash, low sulphur

Smithing—1 1-4 in. screened

Fairmont — Quemahoning — Indiana County

NEW YORK OFFICE: 17 BATTERY PLACE

Branch Offices: Baltimore Buffalo Chicago Scranton, Pa. Mauch Chunk, Pa.

BUYER'S DIRECTORY

ACETYLENE, Dissolved (Or in Cylinders)
Prest-O-Lite Co., Inc., 30 E. 42nd St., N. Y. C.

ACETYLENE GAS
Prest-O-Lite Co., 30 East 42nd St., New York City.

ACETYLENE GENERATING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

ACID, SULPHURIC
Irvington Smelting & Refining Works, Irvington, N. J.

AERIAL TRAMWAYS
American Steel & Wire Co., Chicago and New York.

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

AUTOMATIC CAR CAGES
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

AUTOMATIC (Mine Doors, Truck and Electric Switches)
American Mine Door Co., Canton, Ohio.

AUTOMATIC SWITCH THROWERS
American Mine Door Co., Canton, Ohio.

BATTERIES (Storage, Gas Welding, Cutting, Dissolved Acetylene)
Prest-O-Lite Co., 30 East 42nd St., New York City.

BEARINGS (Roller)
Hyatt Roller Bearing Co., Harrison, N. J.

BELTING (Conveyor, Elevator, Transmission)
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

BELTING, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

BINS (Coke and Coal)
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

BIT SHARPENERS
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.

BLACK DIAMONDS
R. S. Patrick, Sellwood Building, Duluth, Minn.

BLASTING POWDER
Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

BLASTING SUPPLIES
Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

BLOWERS, CENTRIFUGAL
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

BLOWPIPES, Brazing, Carbon Burning, Cutting, Lead Burning, Welding, Welding and Cutting
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

BOND TERMINALS
Amer. Mine Door Co., Canton, Ohio.

BREAKERS (Construction and Machinery)
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

BUCKETS (Elevator)
Hendrick Mfg. Co., Carbondale, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CABLES
American Steel & Wire Co., Chicago and New York.

CABLES (Connectors and Guides)
American Mine Door Co., Canton, Ohio.

CABLEWAYS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

CAGE (Safety Appliances)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

CAGERS, AUTOMATIC
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.
Mining Safety Device Co., Bowerston, Ohio.

CAGES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

CAGES (Self-dumping)
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

CAGE STOPS AND LOCKS
Mining Safety Device Co., Bowerston, Ohio.

CARBON AND BORTZ
R. S. Patrick, Sellwood Building, Duluth, Minn.

CARBON BURNING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

CARBON RODS AND PASTE FOR WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

CAR DUMPERS (Rotary)
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

CAR HAULS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CAR STOPS (Automatic)
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

CAR WHEEL BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

CASTINGS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CHAINS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, AUTOMOBILE ENGINE
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, COAL CUTTING
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CHAINS, DRIVE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, FRONT END
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, OILING
Morse Chain Co., Ithaca, N. Y.

CHAINS, POWER TRANSMISSION
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, SILENT (Rocker-Joint)
Morse Chain Co., Ithaca, N. Y.

CHAINS, SLING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, SPROCKET WHEEL
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CLAMPS (Trolley)
Ohio Brass Co., Mansfield, Ohio.

CLUTCHES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL CLEANING MACHINERY
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

COAL COMPANIES
General Coal Company, Land Title Bldg., Philadelphia, Pa.
Lehigh Coal & Navigation Co., Philadelphia, Pa.
Thorne, Neale & Co., Philadelphia, Pa.

COAL CRUSHERS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL CUTTERS
Goodman Mfg. Co., Halsted St. and 48th Pl. Chicago, Ill.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

COAL HANDLING MACHINERY
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL LOADERS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL MINING MACHINERY
Goodman Mfg Co., Halsted St. and 48th Pl., Chicago, Ill.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

COAL MINING PLANTS
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

COMPRESSORS, AIR
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

COMPRESSORS, MINE CAR
Ingersoll-Rand Co., 11 Broadway, New York City.

CONCENTRATORS (Table)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CONCRETE REINFORCEMENT
American Steel & Wire Co., Chicago and New York

CONDENSERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

CONTROLLERS
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

WHY Linde leads

LINDE'S position as the world's largest producer of oxygen isn't just an accident.

Chance does not build 37 plants nor does it establish for the convenience of users of oxygen everywhere more than 100 warehouses so located that no matter where your plant or shop is situated you are near a Linde source of supply.

Another reason for Linde's leadership is Linde Service.

For years the Linde service organization has studied and perfected applications of the oxy-acetylene process. The results of this development work are made available to customers through our field service staff of welders and engineers and through our publication—Oxy-Acetylene Tips.

THERE has been no more general application of "Safety First" principles than in the use of gear and machine guards. Constructed of angle irons and covered with wire netting, perforated metal or, if protection from oil is desired, with light sheet metal, they can be fabricated by oxy-acetylene welding and cutting. Linde Methods will tell you how to do the job most economically.

THE LINDE AIR PRODUCTS COMPANY
Manufacturers of oxygen, nitrogen, pyrogen, argon and neon
Producers of helium for scientific purposes
GENERAL OFFICES
Carbide and Carbon Building, 30 East 42d Street, New York
37 PLANTS—105 WAREHOUSES

LINDE OXYGEN

CONVERTORS, COPPER

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CONVEYOR BEARINGS

Hyatt Roller Bearing Co., Harrison, N. J.

CONVEYORS

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, BELT

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, CHAIN FLIGHT

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, COAL

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS AND ELEVATORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, PAN OR APRON

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, SCREW

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CORE DRILLING

H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.

COUPLINGS, FLEXIBLE

Fawcus Machine Co., Pittsburgh, Pa.

CROSSINGS AND CROSSOVERS

Central Frog & Switch Co., Cincinnati, Ohio.

CRUSHERS

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CRUSHERS, COAL

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHERS, SINGLE & DOUBLE ROLL

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHING PLANTS, COKE

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CUTTING APPARATUS, Oxy-Acetylene, Oxy-Hydrogen

Oxweld Acetylene Co., 30 E. 42nd St., New York City.

DECARBONIZING APPARATUS

Oxweld Acetylene Co., 30 E. 42nd St., New York City.

DESIGNERS OF PLANTS

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DIAMOND CORE DRILL CONTRACTING

H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.

DIAMOND DRILLING CARBON

R. S. Patrick, Sellwood Building, Duluth, Minn.

DIAMONDS, BLACK (See Carbon and Bortz)

R. S. Patrick, Sellwood Building, Duluth, Minn.

DOORS, AUTOMATIC MINE

American Mine Door Co., Canton, Ohio.

DOUBLE CRIMPED WIRE SCREENS

Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

DRIFTERS, DRILL

Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLING, DIAMONDS FOR

R. S. Patrick, Sellwood Building, Duluth, Minn.

DRILLS, AIR AND STEAM

Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS (Blast Hole)

Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS, CORE

H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.

DRILLS, ELECTRIC

General Electric Co., Schenectady, N. Y.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

DRILLS, HAMMER

Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

DRILLS (Hand Operated Coal)

Howells Mining Drill Co., Plymouth, Pa.
Ohio Brass Co., Mansfield, Ohio.

DRILLS, PNEUMATIC

Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS, PROSPECTING

H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.

DRILLS, ROCK

Diamond Machine Co., Monongahela, Pa.
General Electric Co., Schenectady, N. Y.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

DRILL STEEL SHARPENERS

Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

DRIVES, SILENT CHAIN

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

DRUMS (Hoisting, Haulage)

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DUMP CARS

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

DYNAMITE

Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

DYNAMOS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.

ELECTRICAL APPARATUS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

ELECTRIC DRILLS

Howells Mining Drill Co., Plymouth, Pa.

ELECTRIC HOISTING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

ELECTRIC LOCOMOTIVES

General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Ohio Brass Co., Mansfield, Ohio.

ELECTRIC MINE SUPPLIES

General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

ELECTRIC WIRES AND CABLES

American Steel & Wire Co., Chicago and New York.

ELECTRICAL SUPPLIES

General Electric Co., Schenectady, N. Y.

ELEVATORS

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

ELEVATORS, BUCKET

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

ELEVATOR MACHINERY

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

ENGINES, GAS AND GASOLINE

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

ENGINES (Hoisting and Hauling)

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

ENGINES, OIL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

ENGINES, STEAM

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

ENGINEERS

H. R. Ameling Prospecting Co., Rolla, Mo.

EXPLOSIVES

Atlas Powder Co., Wilmington, Del.
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., 934 King St., Wilmington, Del.

FAN DRIVES

Fawcus Machine Co., Pittsburgh, Pa.

FANS, VENTILATING

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

FEEDERS (Crossover, Kickback, Rotary and Dump)

Mining Safety Device Co., Bowerston, Ohio.

FEEDERS (Hand operated)

Mining Safety Device Co., Bowerston, Ohio.

FEEDERS, ORE

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

FEEDERS (Semi-automatic)

Mining Safety Device Co., Bowerston, Ohio.

FLOORING, STEEL

Hendrick Mfg. Co., Carbondale, Pa.

FLOTATION MACHINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FLOTATION OILS

Hercules Powder Co., 934 King St., Wilmington, Del.

FLOW METERS

General Electric Co., Schenectady, N. Y.

FLUX, WELDING

Oxweld Acetylene Co., 30 E. 42nd St., New York City.

FORGINGS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FROGS AND SWITCHES

Amer. Mine Door Co., Canton, Ohio.
Central Frog & Switch Co., Cincinnati, Ohio.

FURNACES, ROASTING

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

GAS (Cutting, Welding)

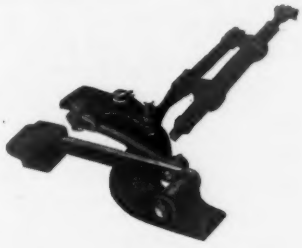
Prest-O-Lite Co., Inc., 30 E. 42d St., New York City.

GAS (Nitrogen, Oxygen)

Linde Air Products Co., 30 E. 42nd St., New York City.

GAUGES, WELDING

Oxweld Acetylene Co., 30 E. 42nd St., New York City.



Track Efficiency

Track safety and efficiency depend upon good materials and good engineering.

We supply both. The results to you mean more uniform operation, better car distribution, fewer delays, minimum traffic congestion, and less equipment required.

THE CENTRAL FROG & SWITCH CO.
CINCINNATI, OHIO

Safety First That Lasts

CENTRAL
Mine Track Equipment

Just "Hammer It"

Hammer the clip
And the rail is fastened

If you are using WEST VIRGINIA steel mine ties. Square shoulders hold track positively to correct gage. No spreading of rails. Pressure on rail cannot loosen tie. Low in ultimate cost. Meets all requirements with five styles and four sections.

FOR ALL RAILS UP TO SEVENTY POUND

Sec. A1—8 to 20 lb. rail
Sec. B1—20 to 30 lb. rail
Sec. B2—35 and 40 lb. rail
Sec. T6—45 to 70 lb. rail

New folder just published on Main Haulage Ties

Send for data and quotations on all West Virginia Track Work

The West Virginia Rail Co.
Huntington, W. Va.

W.VA. RAIL

Insures greater tonnage in marketable sizes

THERE'S a grade of Coalite—the Atlas permissible explosive—to meet every blasting problem encountered in mining coal. The use of the right grade means greater tonnage in marketable sizes at a lower cost. You can improve your blasting results by using the grade of Coalite that is fitted to your particular work. Let the Atlas Service Man help you determine it. Write nearest branch.

COALITE

The permissible explosive
packed in white paper cartridges

ATLAS POWDER COMPANY
WILMINGTON, DELAWARE

Branch Offices:
Allentown, Pa.; Birmingham, Ala.; Boston, Mass.; Charleston, W. Va.; Chicago, Ill.; Des Moines, Iowa; Houghton, Mich.; Joplin, Mo.; Kansas City, Mo.; Knoxville, Tenn.;

ATLAS EXPLOSIVES

Branch Offices:
McAlester, Okla.; New Orleans, La.; New York City, N.Y.; Norristown, Pa.; Philadelphia, Pa.; Pittsburg, Kans.; Pittsburgh, Pa.; Pottsville, Pa.; St. Louis, Mo.; Wilkes-Barre, Pa.

GEARS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

GEARS, BEVEL
Fawcus Machine Co., Pittsburgh, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

GEARS, HERRINGBONE
Fawcus Machine Co., Pittsburgh, Pa.

GEARS, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

GEARS, SPUR
Fawcus Machine Co., Pittsburgh, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

GEARS, WORM
Fawcus Machine Co., Pittsburgh, Pa.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

GEARS, WORM WHEELS
Fawcus Machine Co., Pittsburgh, Pa.

GENERATORS AND GENERATING SETS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

GENERATORS, ACETYLENE
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GLOVES, ASBESTOS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GOGGLES, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GRATING, AREA, SIDEWALK
Hendrick Mfg. Co., Carbondale, Pa.

HANGERS (Insulated Trolley)
Ohio Brass Co., Mansfield, Ohio.

HEADLIGHTS, ARC AND INCANDESCENT
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Ohio Brass Co., Mansfield, Ohio.

HERRINGBONE GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

HOIST DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

HOISTS
American Steel & Wire Co., Chicago and New York.
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

HOISTS, AIR
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

HOISTS, ELECTRIC
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Diamond Machine Co., Monongahela, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

HOISTS, PORTABLE
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

HOISTS, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

HOISTS (Room and Gathering)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

HOISTING ROPES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

HOSE, AIR AND STEAM
Ingersoll-Rand Co., 11 Broadway, New York City.

HOSE, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

INSULATORS, FEEDER WIRE
Ohio Brass Co., Mansfield, Ohio.

INSULATORS, SECTION
Amer. Mine Door Co., Canton, Ohio.
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Porcelain)
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Third Rail)
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Trolley)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

INSULATED WIRE AND CABLE
American Steel & Wire Co., Chicago, Ill.
Roebling Sons, John A., Trenton, N. J.

KILNS (Rotary)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

LAMPS, ARC AND INCANDESCENT
General Electric Co., Schenectady, N. Y.

LEAD BURNING APPARATUS, Oxy-Acetylene, Oxy-City Gas
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

LOADERS (Mine Car)
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOADERS, PORTABLE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOADING BOOMS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

LOADING MACHINES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOCOMOTIVES, ELECTRIC
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

LOCOMOTIVES, RACK RAIL
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

LOCOMOTIVES, STORAGE BATTERY
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MACHINERY, TRANSMISSION (Power)
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

MANIFOLDS, OXYGEN
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

MILLS, ROD & BALL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MILLS, STAMP
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MINE CAR BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

MINE DOORS, AUTOMATIC
American Mine Door Co., Canton, Ohio.

MINING & METALLURGICAL MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MINING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINING MACHINES
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINING MACHINES (Electric)
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Howells Mining Drill Co., Plymouth, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINING MACHINERY
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINE SIGNALS
American Mine Door Co., Canton, Ohio.

MOTORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

NITROGEN GAS
Linde Air Products, 30 East 42nd St., New York City.

ORE, BUYERS AND SELLERS OF
Irvington Smelting & Refining Works, Irvington, N. J.
Phelps-Dodge Corporation, New York City.

OXYGEN GAS
Linde Air Products, 30 East 42nd St., New York City.

OXY-ACETYLENE APPARATUS and SUPPLIES
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

PATENT ATTORNEY
John Boyle, Jr., Ouray Bldg., Washington, D. C.

PERFORATED METAL
Hendrick Mfg. Co., Carbondale, Pa.

PERMISSIBLES, Explosives
Atlas Powder Co., Wilmington, Del.
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.

PICKING TABLES
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

PIPE (Wood)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PNEUMATIC TOOL
Ingersoll-Rand Co., 11 Broadway, New York City.

POWDER, BLASTING
Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

POWER TRANSMISSION MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

PREHEATING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

PROSPECTIVE DRILLS
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

PULLEYS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

PULVERIZERS, COAL AND COKE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

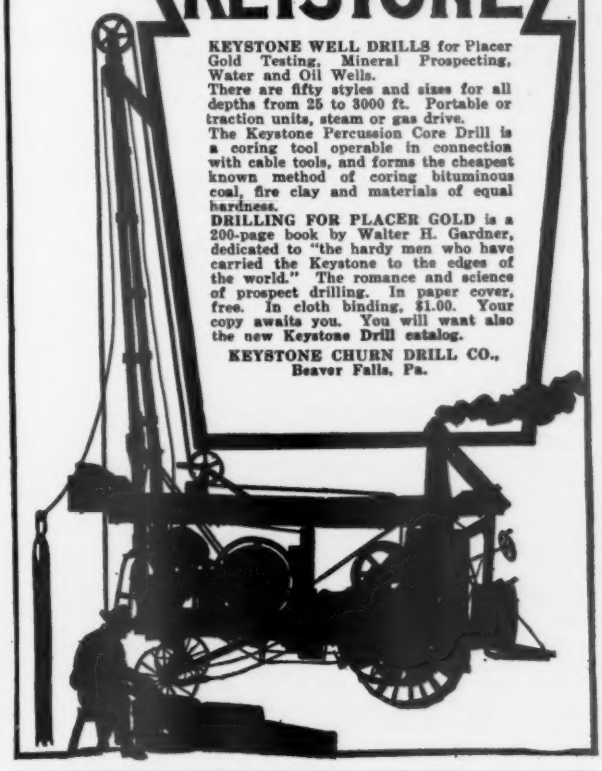
PUMPS, AIR LIFT
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, CENTRIFUGAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, MINE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

KEYSTONE



KEYSTONE WELL DRILLS for Placer Gold Testing, Mineral Prospecting, Water and Oil Wells.
There are fifty styles and sizes for all depths from 25 to 3000 ft. Portable or traction units, steam or gas drive.
The Keystone Percussion Core Drill is a coring tool operable in connection with cable tools, and forms the cheapest known method of coring bituminous coal, fire clay and materials of equal hardness.
DRILLING FOR PLACER GOLD is a 200-page book by Walter H. Gardner, dedicated to "the hardy men who have carried the Keystone to the edges of the world." The romance and science of prospect drilling. In paper cover, free. In cloth binding, $1.00. Your copy awaits you. You will want also the new Keystone Drill catalog.

KEYSTONE CHURN DRILL CO.,
Beaver Falls, Pa.

PATRICK CARBON
for Diamond Core Drilling

When you buy carbon from Patrick you expect the utmost in economy and satisfaction. Patrick facilities for buying, Patrick fidelity in grading, and Patrick fairness in selling are your absolute guarantee under all drilling conditions.

R. S. PATRICK
Duluth, Minnesota, U.S.A.
Cable Address, "Exploring" Duluth

CORE DRILLING
H. R. AMELING PROSPECTING COMPANY, INC.

Diamond Drill Contractors
20 Years' Continuous Service
Not a Dissatisfied Customer

ROLLA, MISSOURI

Home: State Geologic Survey, Missouri School of Mines

DIAMOND CORE DRILLING
CONTRACTORS
Testing Coal, Clays, and All Mineral Properties
Large Capacity Drills --- Gasoline Outfits
Foundation Testing
MOTT CORE DRILLING CO.
R-P Bldg. HUNTINGTON, W.

ORVIS C. HOFFMAN, Pres. **LEON H. HOFFMAN, Treas.**
HOFFMAN BROS. DRILLING CO.
PUNXSUTAWNEY, PA.
DIAMOND CORE DRILLING
CONTRACTORS
PROSPECTING FOR ANY MINERAL. MORE THAN 20 YEARS EXPERIENCE. SATISFACTION GUARANTEED

Cars That Cut Costs

AT a cost of 1½ cents per ton, Half Mountain Coal Company produced 200,000 tons, hauled it 4,200 feet with 20 Enterprise cars—all in a short, two-year period.

Mr. Cain, president of the company, advises that "we haven't spent a nickel for repairs in that length of time." We have dismissed the mine-car problem as solved by your cars."

In short, the **total** cost of the cars has been paid in two years at the rate of slightly less than 1½ cents per ton for the 200,000 tons.

This performance, while significant, is not unprecedented. An inquiry concerning your needs will bring the performance data of Enterprise cars and trucks in more than 200 operations—as well as a practical method for cutting both initial equipment costs and the cost-per-ton.

ENTERPRISE
WHEEL & CAR CORPORATION

Mine Cars and Roller Bearing Trucks

BRISTOL, VA. HUNTINGTON, W. VA.

PUMPS (Gathering or Dip)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PUMPS, PNEUMATIC AIR LIFT
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, POWER
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, SAND
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, STEAM
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, VACUUM
Ingersoll-Rand Co., 11 Broadway, New York City.

QUARRYING MACHINERY
Ingersoll-Rand Co., 11 Broadway, New York City.

RAIL BONDS
American Steel & Wire Co., Chicago and New York.
Ohio Brass Co., Mansfield, Ohio.

RAILWAY SUPPLIES
Ohio Brass Co., Mansfield, Ohio.

REGULATORS, Welding, Compressed Gas
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

RETARDERS
Mining Safety Device Co., Bowerston, Ohio.

ROCK-DISPOSAL EQUIPMENT
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

ROCK DRILLS
Howells Mining Drill Co., Plymouth, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

ROCK DUSTING MACHINES
Diamond Machine Co., Monongahela, Pa.

RODS, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

ROLLER BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

ROLLS (Crushing)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

ROPE
American Steel & Wire Co., Chicago and New York.

ROPE, TRANSMISSION
American Steel & Wire Co., Chicago and New York.
Roebling Sons, John A., Trenton, N. J.

ROPE, WIRE
American Steel & Wire Co., Chicago and New York.
Roebling Sons, John A., Trenton, N. J.

ROTARY DUMPS
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

SAFETY APPLIANCES, MINE
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

SCRAPER LOADERS
Goodman Mfg Co., Halsted St. and 48th Place, Chicago, Ill.

SCREENS, HORIZONTAL
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

SCREENS, PERFORATED METAL
Hendrick Mfg. Co., Carbondale, Pa.

SCREENS, REVOLVING
Hendrick Mfg. Co., Carbondale, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SCREENS, SHAKER
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SCREENS AND PERFORATED SHEETING
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.

SHARPENERS, DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.
Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

SHORT WALL ANCHORS
Amer. Mine Door Co., Canton, Ohio.

SIGNS (Mine)
Stonehouse Signs, Inc., 842 Larimer St., Denver, Colo.

SINKERS, ROCK DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

SKIPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SKIP LOADING EQUIPMENT
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.

SMELTERS
Irvington Smelting & Refining Works, Irvington, N. J.

SPECIAL MACHINERY
Fawcus Machine Co., Pittsburgh, Pa.

SPEED REDUCERS, DOUBLE
Fawcus Machine Co., Pittsburgh, Pa.

SPEED REDUCERS, SINGLE
Fawcus Machine Co., Pittsburgh, Pa.

SPLICE, CABLE
American Mine Door Co., Canton, Ohio.
Ohio Brass Co., Mansfield, Ohio.

SPLICE, INSULATOR
American Mine Door Co., Canton, Ohio.

SPLICE, TROLLEY WIRE
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

SPLICERS, TROLLEY
Amer. Mine Door Co., Canton, Ohio.

SPROCKETS, COMPENSATING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPROCKETS, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPROCKETS, SPRING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPUR GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

STACKS, SMOKE
Hendrick Mfg. Co., Carbondale, Pa.

STEEL, ALLOY
Central Steel Co., Massillon, Ohio.

STEEL, HIGH FINISH SHEET
Central Steel Co., Massillon, Ohio.

STEEL, HOLLOW & SOLID DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

STEEL PLATE CONSTRUCTION
Hendrick Mfg. Co., Carbondale, Pa.

STEEL, REINFORCING
American Mine Door Co., Canton, Ohio.

STEEL, STRIP
Central Steel Co., Massillon, Ohio.

STEPS, SAFETY
Hendrick Mfg. Co., Carbondale, Pa.

STOPERS, ROCK DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

STORAGE BATTERY LOCOMOTIVES
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

SURVEYOR'S SPADS
Howells Mining Drill Co., Plymouth, Pa.

SWITCHBOARDS, POWER
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

SWITCHES (Disconnecting and Electric)
General Electric Co., Schenectady, N. Y.

SWITCHES AND FROGS, TROLLEY
American Mine Door Co., Canton, Ohio.
Central Frog & Switch Co., Cincinnati, Ohio.
Ohio Brass Co., Mansfield, Ohio.

TIES, (Steel, Mine)
Central Frog & Switch Co., Cincinnati, Ohio.

TIMBER PRESERVING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TIPPLES
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

TIPPLE EQUIPMENT
Car-Dumper & Equipment Co., Grand Crossing, Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

TORCHES, Brazing, Carbon Burning, Cutting, Lead Burning, Welding, Welding and Cutting
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

TRACKS, PORTABLE, RAIL, ETC.
Central Frog & Switch Co., Cincinnati, Ohio.
West Virginia Rail Co., Huntington, W. Va.

TRACK, (Portable, Assembled and Unassembled, Riveted or Bolted),
Central Frog & Switch Co., Cincinnati, Ohio.

TRACK SUPPLIES
Central Frog & Switch Co., Cincinnati, Ohio.

TRANSFORMERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TRANSMISSION, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

TREADS, SAFETY STAIR
Hendrick Mfg. Co., Carbondale, Pa.

TROLLEY FROGS
Ohio Brass Co., Mansfield, Ohio.

TROLLEY (Hangers and Clamps)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

TROLLEY MATERIAL, OVERHEAD
Ohio Brass Co., Mansfield, Ohio.

TROLLEY WHEELS AND HARPS
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Ohio Brass Co., Mansfield, Ohio.

TRUCKS, WELDER'S
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

TURBINES, HYDRAULIC
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TURBINES, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

VALVES
Ohio Brass Co., Mansfield, Ohio.

VALVES, Back Pressure, Pressure Reducing
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WAGON LOADERS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

WASHERIES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

WELDING and CUTTING APPARATUS, Etc. (Oxy-Acetylene)
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WELDING APPARATUS, ELECTRIC ARC
Ohio Brass Co., Mansfield, Ohio.

WELDING GAS
Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City.

WELDING SUPPLIES
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WIRE AND CABLE
American Steel & Wire Co., Chicago and New York.
Roebling Sons, The John A., Trenton, N. J.

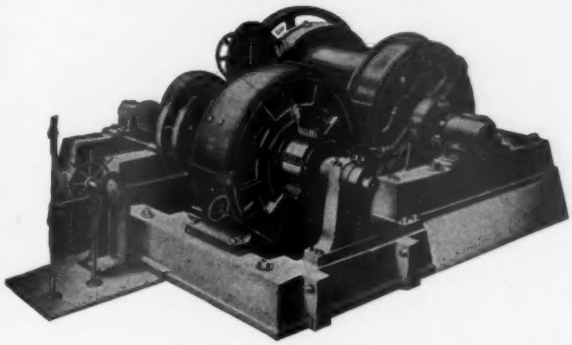
WIRE ROPE FITTINGS
American Steel & Wire Co., Chicago and New York.

WIRE, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WORM GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa

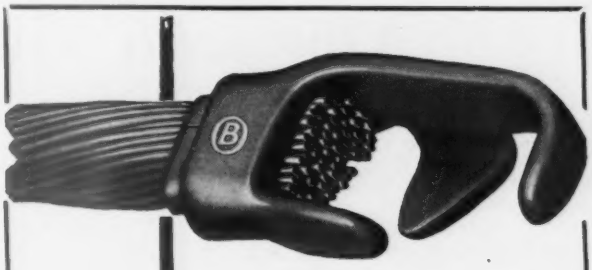
The Connellsville Manufacturing and Mine Supply Company

Connellsville, Pa.



If you need any cost reducing mine equipment, write us.

The Cage, Hoist and Fan Builder



BETTER bonding, fewer breaks and less upkeep cost are the substantial advantages users find in the OB copper arc-weld bond.

Made in standard bond lengths.

Ohio Brass Company
Mansfield, O.
Dominion Insulator & Mfg. Co. Limited
Niagara Falls, Canada
157-M

Ohio Brass Co.

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES

ROCK DUSTING

in the most thorough and efficient manner is rapidly accomplished with

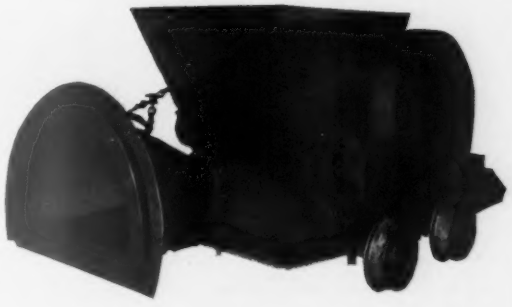
The Legrabon MINE DUSTING MACHINE

due to its positive feed, large capacity, high velocity of discharge and the peculiar construction of the nozzle.
Unvarying good performance in actual rock dusting practice for several months past has proven it a finished product and not an experiment.

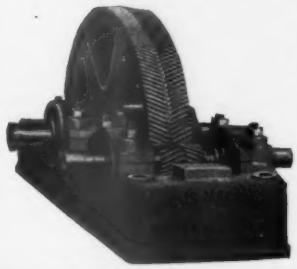
Our new bulletin gives the details.

DIAMOND MACHINE COMPANY
Monongahela, Pa.

Selling Agents: Cooke-Wilson Electric Supply Company
Pittsburgh, Pa., Athens, Ohio, Charleston, W. Va.

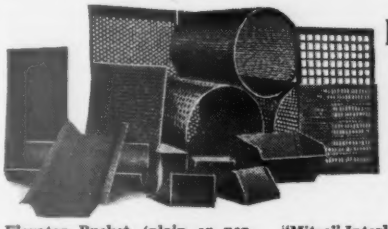


FAWCUS



Use Fawcus Herringbone Gear Drives for driving your hoists, fans, conveyors, picking tables, pumps and compressors. They save 25% to 50% in maintenance and operating costs.

FAWCUS MACHINE CO.
PITTSBURGH, PA.



PERFORATED METAL SCREENS *for every purpose*

Elevator Bucket (plain or perforated)
Stacks and Tanks

"Mitco" Interlocked Steel Grating
Light and Heavy Steel Plate Construction

HENDRICK MFG. CO., Carbondale, Pa.

New York Office 30 Church St.
Pittsburgh Office: 954 Union Trust Bldg.
Hazleton, Pa., Office: 705 Markle Bank Bldg.

American Mining Congress

OFFICERS AND COMMITTEES, 1926

OFFICERS

Hugh Shirkie, *President*
E. L. Doheny, *First Vice-President*
Wm. H. Lindsey, *Second Vice-President*
Robert E. Tally, *Third Vice-President*
J. F. Callbreath, *Secretary*

DIVISION STAFF

George H. Bailey, *Counsel*
M. W. Kriegh, *Tax Division*
Dr. Henry Mace Payne, *Consulting Engineer*
E. H. Pullman, *Publicity Department*
E. R. Coombes, *Asst. to Secretary*

DIRECTORS

Bulkeley Wells, San Francisco, Calif.
Sidney J. Jennings, New York, N. Y.
S. Pemberton, Hutchinson, Philadelphia, Pa.
George B. Harrington, Chicago, Ill.
Wm. H. Lindsey, Nashville, Tenn.
J. G. Bradley, Dundon, W. Va.
W. J. Loring, Los Angeles, Calif.
H. W. Seaman, Chicago, Ill.
E. L. Doheny, New York, N. Y.
Hugh Shirkie, Terre Haute, Ind.
Stanly Easton, Kellogg, Idaho.
L. S. Cates, Salt Lake City, Utah.
Robert E. Tally, Clarkdale, Ariz.

EXECUTIVE COMMITTEE

H. W. Seaman — Hugh Shirkie
George B. Harrington

WESTERN DIVISION

BOARD OF GOVERNORS

Jesse F. McDonald, Denver Colo., *Chairman of the Division.*
M. B. Tomblin, 437 State Office Bldg., Denver, Colo., *Secretary of the Division.*
Arizona—Robert E. Tally, United Verde Copper Co., Jerome, Ariz.; W. B. Gohring, 419 Heard Building, Phoenix, Ariz.
California—Robert I. Kerr, 509 United Bank & Trust Co. Bldg., 625 Market St., San Francisco, P. C. Knapp, Natomas Co. of Calif., San Francisco.
Colorado—Jesse F. McDonald, Denver, Colo.; M. B. Tomblin, 437 State Office Building, Denver, Colo.
Idaho—A. P. Ramstedt, Wallace, Idaho; Ravenel Macbeth, Idaho Mining Association, Wallace, Idaho.
Nevada—Henry M. Rives, Nevada Mine Operators' Assn., Reno, Nev.
New Mexico—John M. Sully, Chino Copper Co., Hurley, N. M.; Jos. Woodbury, New Mexico Chapter, The American Mining Congress, Silver City, N. Mex.
Oregon—Robert M. Betts, Cornucopia Mining Co., Cornucopia, Oreg.
South Dakota—B. C. Yates, Homestake Mining Co., Lead, S. Dak.
Utah—V. S. Rood, Utah Apex Mining Co., Bingham, Utah; A. G. Mackenzie, 212 Kearns Building, Salt Lake City, Utah.
Washington—Raymond Guyer, Symons Building, Spokane, Wash.

SOUTHERN DIVISION

BOARD OF GOVERNORS

C. J. Griffith, Arkansas Central Power Co., Little Rock, Ark., *Chairman of the Division.*
H. B. Flowers, New Orleans Public Service, Inc., New Orleans, La.
Howard I. Young, American Zinc Company of Tennessee, Mascot, Tenn.
I. N. Day, Dawson Springs, Ky.
W. H. Smith, Sec'y-Mgr., Chamber of Commerce, Laurel, Miss.
J. L. Davidson, Secy., Alabama Mining Institute, Birmingham, Ala.
C. G. Memminger (Florida) Pres., Coronet Phosphate Co., Asheville, N. C.
J. M. Mallory, Industrial Agent, Central of Georgia Rwy., Savannah, Ga.
E. L. Hertzog, Cherokee Mining Co., Spartanburg, S. C.
Dr. A. F. Greaves-Walker, Dean, School of Ceramics, Raleigh, N. C.
C. W. Johnson, Manager, The Virginia Smelting Co., West Norfolk, Va.
J. G. Bradley, Elk River Coal & Lumber Co., Dundon, W. Va.
S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.
Prof. E. E. Tourtelotte, Pres., School of Mines, Wilburton, Okla.

MANUFACTURERS DIVISION OFFICERS

Honorary Chairmen

N. S. Greensfelder, Hercules Powder Co., Wilmington, Del.
J. C. Wilson, Ohio Brass Co., Mansfield, Ohio.

Chairman

H. K. Porter, Hyatt Roller Bearing Co., Harrison, N. J.

Vice-Chairmen

H. A. Buzby, Keystone Lubricating Co., Philadelphia, Pa.
C. L. Herbster, Hockensmith Wheel & Mine Car Co., Penn, Pa.
F. J. Maple, John A. Roebling's Sons Co., Trenton, N. J.

Members

American Car & Foundry Co., 30 Church St., New York City. H. C. Wick.
Atlas Powder Co., Wilmington Del. G. S. Scott.
Automatic Reclosing Circuit Breaker Co., Columbus, Ohio. C. M. Hickle.
Carnegie Steel Co., Pittsburgh, Pa. R. L. Twitchell.
Central Frog & Switch Co., Cincinnati, Ohio. E. R. Heitzmann.
Cutler-Hammer Mfg. Co., Milwaukee, Wisc. G. S. Crane.
Dravo-Doyle Co., Dravo Bldg., Pittsburgh, Pa. E. F. Austin.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. E. F. Carley.
Edison Storage Battery Co., Orange, N. J. G. E. Stringfellow.
Electric Railway Equipment Co., Cincinnati, Ohio. A. L. Johnston.
Enterprise Wheel & Car Corp., Bristol, Va.-Tenn., C. P. Daniel.
General Electric Co., Schenectady, N. Y. L. W. Shugg.
Hendrick Mfg. Co., Carbondale, Pa. H. S. Lee.
Hercules Powder Co., Wilmington, Del. N. S. Greensfelder.
Hockensmith Wheel & Mine Car Co., Penn, Pa. C. L. Herbster.
Robt. Holmes & Bros., Inc., Danville, Ill. Grant Holmes, Pres.
Hyatt Roller Bearing Co., Newark, N. J. H. K. Porter.
Keystone Consolidated Publishing Co. Ralph C. Becker, 10th Ave. at 36th St., New York City.
Keystone Lubricating Co., Philadelphia, Pa. H. A. Buzby.
Link-Belt Co., Chicago, Ill. Rex Martin.
Ludlow-Saylor Wire Co., St. Louis, Mo. Duncan Meier.
Mancha Storage Battery Locomotive Co., St. Louis, Mo. Raymond Mancha.
Myers-Whaley Co., Knoxville, Tenn. Wm. A. Whaley.
Morse Chain Co., Ithaca, N. Y. C. L. Saunders.
National Carbon Co., Inc., 30 E. 42d St., New York City. E. A. Williford.
Ohio Brass Co., Mansfield, Ohio. J. C. Wilson.
Phillips Mine & Mill Supply Co., Pittsburgh, Pa. J. Milton Duff.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill. Col. W. R. Roberts, Pres.
John A. Roebling's Sons Co., Trenton, N. J. F. J. Maple.
Southern Wheel Co., St. Louis, Mo. F. C. Turner, Vice-Pres., 1308 Keystone Bldg., Pittsburgh, Pa.
Streeter-Amet Weighing & Recording Co., Chicago, Ill. H. F. Reck.
Timken Roller Bearing Co., Canton, Ohio. E. R. Phillips.
W. S. Tyler Co., Cleveland, Ohio. M. P. Reynolds.
Watt Car & Wheel Co., Barnesville, Ohio. H. H. Watt.
Weir Kilby Corpn., Cincinnati, Ohio. J. K. Lansdowne.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. P. H. Grunnagle.

TAX DIVISION

GENERAL TAX COMMITTEE

Paul Armitage, *Chairman*
233 Broadway, New York, N. Y.
Geo. E. Holmes, *Vice-Chairman*
15 William St., New York, N. Y.

R. C. Allen, Hanna Building, Cleveland, Ohio.
A. Scott Thompson, Miami, Okla.
Wm. B. Gower, 20 Exchange Place, New York, N. Y.
R. V. Norris, 520 Second National Bank Bldg., Wilkes-Barre, Pa.
J. C. Dick, 511 Newhouse Bldg., Salt Lake City, Utah.
A. P. Ramstedt, Wallace, Idaho.
E. L. Doheny, 120 Broadway, New York City.
T. O. McGrath, Bisbee, Ariz.
Robt. N. Miller, Southern Bldg., Washington, D. C.
H. B. Fernald, 50 Broad St., New York City.
T. T. Brewster, Federal Res. Bank Bldg., St. Louis, Mo.
Wm. N. Davis, Bartlesville, Okla.

STANDARDIZATION DIVISION
Metal and Coal Mining Branches
COAL MINING BRANCH

General Committee

Colonel Warren R. Roberts (*Chairman*), Pres., Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.
A. B. Kiser, Supt. of Elec. Equipment, Pittsburgh Coal Co., Pittsburgh, Pa.
R. E. Krape, Gen. Mgr., Timber Dept., Rochester & Pittsburgh Coal & Iron Co., Indiana, Pa.
J. A. Maladv, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., 2307 First Natl. Bank Bldg., Pittsburgh, Pa.
James Needham, Genl. Supt. of Mines, St. Paul Coal Co., 1368 Fullerton Ave., Chicago, Ill.
Fred Norman, Chf. Engr., Allegheny River Mining Co., Kittanning, Pa.
F. L. Stone, Industrial Engr. Dept., General Electric Co., Schenectady, N. Y.
C. H. Trik, Sales and Mine Ventilation Engr., Jeffrey Mfg. Co., Columbus, Ohio.
L. E. Young, Gen. Mgr., Union Colliery Co., 400 Union Electric Bldg., St. Louis, Mo.

Underground Transportation
Fred Norman, *Chairman*

MAIN COMMITTEE

Fred Norman (*Chairman*), Chf. Engr., Allegheny Rivers Mining Co., Kittanning, Pa.
Frank S. Barks, Pres., Lincoln Steel and Forge Co., St. Louis, Mo.
Graham Bright, Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
Jos. Bryan, Salesman, General Electric Co., 535 Smithfield St., Pittsburgh, Pa.
John T. Cherry, Genl. Supt., B. F. Berry Coal Co., Standard, Ill.
Frederick C. Coseo, Chf. Draftsman, Jeffrey Mfg. Co., Columbus, Ohio.
A. H. Ehle, Mgr., Domestic Sales, Baldwin Locomotive Works, 500 N. Broad St., Philadelphia, Pa.
W. J. Fene, Asst. Chf. Engr., Mine Safety Service, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
Robert J. Forester, Supt., Paradise Coal Co., Du Quoin, Ill.
J. B. Forrester, Chf. Engr., United States Fuel Co., Hiawatha, Utah.
D. F. Lepley, Pres. & Genl. Mgr., Connellsville Mfg. and Supply Co., Connellsville, Pa.
J. D. Martin, Genl. Supt. of Coal Mines, Virginia Iron, Coal & Coke Co., Payne Bldg., Roanoke, Va.
Charles M. Means, Cons. Engr., Charles M. Means Company, 447 Oliver Bldg., Pittsburgh, Pa.
James Milliken, Pres., Pittsburgh Testing Laboratory, P. O. Box 1115, Pittsburgh, Pa.
T. A. Parker, 407 Olive St., St. Louis, Mo.
Chas. H. Partington, Chief Engr., Cincinnati Frog & Switch Co., Cincinnati, Ohio.
H. K. Porter, Car & Truck Dept., Hyatt Roller Bearing Co., Newark, N. J.
G. H. Shapter, Commercial Engr., Industrial Dept., General Electric Co., Erie, Pa.
E. A. Watters, Genl. Supt., Hick Coal Companies, Box 405, Leechburg, Pa.
C. E. Watts, Mech. Engr., Berwind White Coal Mining Co., Windber, Pa.

SUB-COMMITTEE NO. 1—COAL MINE CAR DESIGN AND CONSTRUCTION

Arthur Neale (Chairman), Ass't. Genl. Mgr. of Mines, Pittsburgh Coal Co., 1018 Oliver Bldg., Pittsburgh, Pa.
H. M. Estabrook, Standard Steel Car Co., Frick Bldg., Pittsburgh, Pa.
C. L. Herbster, Vice-Pres., Hockensmith Wheel & Mine Car Co., Penn, Pa.
R. L. Kingsland, Genl. Supt., Power & Mechanical Dept., Consolidation Coal Co., Fairmont, W. Va.
James Milliken, Pres., Pittsburgh Testing Laboratory, P. O. Box 1115, Pittsburgh, Pa.
W. C. Sanders, Rwy. Equipment Engr., Timken Roller Bearing Co., Canton, Ohio.
C. E. Watts, Mech. Engr., Berwind White Coal Mining Co., Windber, Pa.
Victor Willoughby, Gen. Mech. Engr., Amer. Car & Foundry Co., 165 Broadway, New York City.
C. K. Witmer, Master Mechanic, Westmoreland Coal Co., Irwin, Pa.

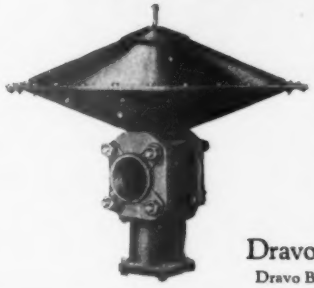
SECTIONAL COMMITTEE ON TYPES OF HAND BRAKES

R. H. Kudlich (Chairman), U. S. Bureau of Mines, Washington, D. C.
Thos. G. Fear, Genl. Supt., Inland Collieries Co., Indianola, Pa.
Wm. J. Hill, Senior Mine Inspector, Travelers Insurance Co., 1103 Commonwealth Bldg., Pittsburgh, Pa.
W. H. Robinson, Chf. Inspector, The Associated Companies, 207 Fulton Bldg., Pittsburgh, Pa.

SECTIONAL COMMITTEE ON MINE CAR WHEELS

C. K. Witmer (Chairman), Master Mechanic, Westmoreland Coal Co., Irwin, Pa.
W. E. Farrell, Pres., Easton Car and Construction Co., Easton, Pa.
John M. Lewis, Chf. Engr., Houston Coal and Coke Co., 1532 Union Trust Bldg., Cincinnati, O.
Arthur Neale, Asst. Genl. Mgr. of Mines, Pittsburgh Coal Co., 1018 Oliver Bldg., Pittsburgh, Pa.
Cecil W. Smith, Chf. Engr., Illinois Coal Corpn., 1380 Old Colony Bldg., Chicago, Ill.
W. G. Srodes, Supt., Coal and Coke Dept., Shenango Furnace Co., Ligonier, Pa.

Curtis Automatic Suction Valves—



Eliminate the need for a pump man. Permit the use of fewer pumps and smaller pipe lines. Make your gathering pumps automatic and more efficient.

Dravo-Doyle Company
Dravo Building—300 Penn Avenue
PITTSBURGH

THE KEYSTONE LUBRICATING CO.
Executive Office and Works: Philadelphia, Pa.

ROTARY CAR DUMPERS FOR MINE CARS
(GRAVITY, ELECTRIC OR PNEUMATIC DRIVE)
"SOLIDCAR" SELF-DUMPING CAGES
ROTARY DUMPERS FOR RAILROAD CARS
NON-SPILLAGE GATES FOR SKIP LOADING
CAR-DUMPER & EQUIPMENT CO.
CAR CONTROL AND CAGING EQUIPMENT
AUTOMATIC TRIP CONTROL DEVICES
MECHANICAL SPRAGGERS—STAR WHEEL OR CHAIN
MAIN OFFICE AND WORKS, GRAND CROSSING, CHICAGO
PITTSBURGH OFFICE, WESTINGHOUSE BUILDING

A. LESCHEN & SONS ROPE CO.

EXPERIENCED MANUFACTURERS OF

WIRE ROPE AND AERIAL WIRE ROPE TRAMWAYS

SOLE MAKERS OF
"Hercules" (Red-Strand) Wire Rope
ST. LOUIS, MO.
NEW YORK CHICAGO DENVER SAN FRANCISCO

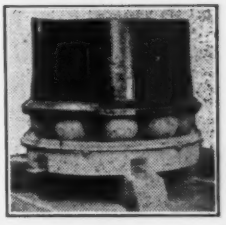
NoLAN Automatic Feeding Systems

Include machines for all conditions found at any mine. Send us your problems and let us show you our method of economically handling your cars.

The Mining Safety Device Co.
Bowerston, Ohio

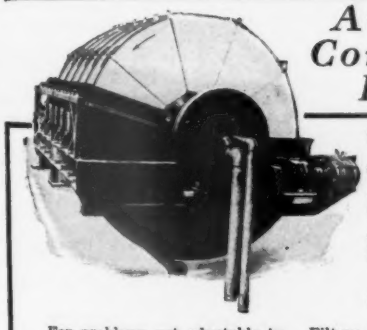
No shafts, no gear, no friction. Will crush with 1 h. p. as much as 10 h. p. will crush with stamps.

5-ton mill, ½ h. p., $225; 10-ton mill, $475; 35-ton mill, $950. Up to 500 tons per day.



ELLIS BALL-CHILI MILL

ELLIS MILL COMPANY
OFFICE: 147 PROSPECT AVENUE
Show Room: 153 Stillman St. (near 3d and Bryant)
SAN FRANCISCO, CALIF.

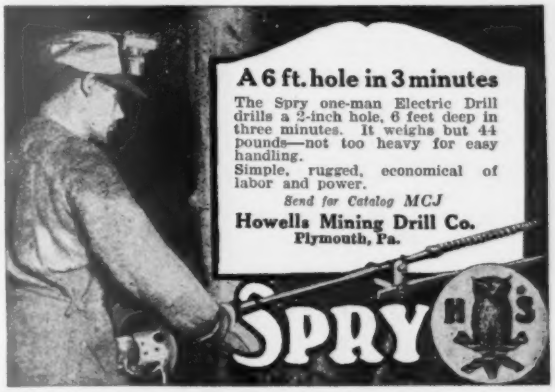


American Continuous Filters

Handle—
Two or more products simultaneously.
Fast settling materials without mechanical agitators.
Concentrates of all kinds, often direct from flotation machines.
Blast furnace flue dust.
Slimes — cyanide, electrolytic, etc.

For problems not adaptable to the American, we have the Sweetland and Kelly Pressure Filters, the United Filter Press, and the Sweetland Thickener.

UNITED FILTERS CORPORATION
HAZLETON PENNA.


A 6 ft. hole in 3 minutes
The Spry one-man Electric Drill drills a 2-inch hole, 6 feet deep in three minutes. It weighs but 44 pounds—not too heavy for easy handling.
Simple, rugged, economical of labor and power.
Send for Catalog MCJ
Howells Mining Drill Co.
Plymouth, Pa.
SPRY

OFFICERS AND COMMITTEES, 1926—(Continued)

SUB-COMMITTEE NO. 2—MINE TRACKS AND SIGNALS

Chas. H. Partington (*Chairman*), Chief Engineer, The Cincinnati Frog & Switch Co., Cincinnati, Ohio.
C. A. Alden, Chief Engineer, Frog & Switch Dept., Bethlehem Steel Co., Steelton, Pa.
Geo. Ashton, Pres., The Central Frog & Switch Co., Cincinnati, Ohio.
Geo. M. Crawford, Crawford Machinery Co., Bessemer Bldg., Pittsburgh, Pa.
A. A. Culp, Consulting Engineer, Brown-Marx Bldg., Birmingham, Ala.
T. H. Edelblute, Representative of the Cincinnati Frog & Switch Co., Wabash Bldg., Pittsburgh, Pa.
Wm. F. Henke, Asst. Engr., the Cincinnati Frog & Switch Co., Cincinnati, Ohio.
F. C. Hohn, Consulting Engineer, Pennsylvania Appraisement Co., Scranton, Pa.
Wm. G. Hulbert, Genl. Supt., Wm. Wharton, Jr., Company, Easton, Pa.
R. L. Ireland, Jr., M. A. Hanna Co., Cleveland, Ohio.
H. L. Koch, Mgr., Industrial Dept., Sweet's Steel Co., Williamsport, Pa.
Fred Norman, Chief Engineer, Allegheny River Mining Co., Kittanning, Pa.
W. Perdue, Chief Engineer, Western Plants, Ramapo-Ajax Corporation, Chicago, Ill.
S. F. Perry, Representative of the Cincinnati Frog & Switch Co., Pittsburgh, Pa.
J. B. Strong, President, Ramapo-Ajax Corporation, 30 Church St., New York City.
J. R. Ulrich, Bethlehem Steel Co., Bethlehem, Pa.
H. N. West, Chief Engineer, Weir-Kilby Corporation, Norwood, Ohio.

SUB-COMMITTEE NO. 3—MINE LOCOMOTIVES

Graham Bright (*Chairman*), Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
Jos. Bryan, Salesman, General Electric Co., 535 Smithfield St., Pittsburgh, Pa.
Frederick C. Coseo, Chf. Draftsman, Jeffrey Mfg. Co., Columbus, Ohio.
A. H. Ehle, Mgr., Domestic Sales, Baldwin Locomotive Works, 500 N. Broad St., Philadelphia, Pa.
S. W. Farnham, Mng., Engr., Goodman Mfg. Co., 4834 S. Halstead St., Chicago, Ill.
W. J. Fene, Asst. Chf. Engr., Mine Safety Service, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
G. H. Shapter, Commercial Engr., Industrial Dept., General Electric Co., Erie, Pa.

Mining and Loading Equipment

L. E. Young, *Chairman*

SUB-COMMITTEE NO. 1—LOADERS

T. E. Jenkins (*Chairman*), Vice-Pres., West Kentucky Coal Co., Sturgis, Ky.
Newell G. Alford, Cons. Engr., Howard N. Eavenson & Associates, Union Trust Bldg., Pittsburgh, Pa.
Frank E. Cash, United States Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
A. C. Green, Goodman Mfg. Co., Chicago, Ill.
G. W. Hay, Genl. Mgr., Consolidation Coal Co., Jenkins, Ky.
F. V. Hicks, Union Pacific Coal Co., Rock Springs, Wyoming.
N. D. Levin, Jeffrey Mfg. Co., Columbus, Ohio.
N. H. McClevey, Vice-Pres. & Genl. Mgr., Pike County Coal Corpn., Petersburg, Ind.
E. S. McKinlay, Pres., McKinlay Mng. & Loading Machine Co., Pt. Pleasant, W. Va.
Alex Palmros, Link-Belt Co., Philadelphia, Pa.
Norton A. Newdick, The Coloder Co., Columbus, Ohio.
W. D. Turnbull, Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wm. Whaley, Genl. Mgr., Myers-Whaley Co., Knoxville, Tenn.

SUB-COMMITTEE NO. 2—CONVEYORS

A. P. Cameron (*Chairman*), Vice-Pres., Westmoreland Coal Co., Irwin, Pa.
C. H. Adamson, Stephens-Adamson Mfg. Co., Aurora, Ill.
W. L. Affelder, Asst. to Pres., Hillman Coal & Coke Co., First Natl. Bank Bldg., Pittsburgh, Pa.
J. A. Appleton, Ironton Engine Co., Ironton, Ohio.
John S. Beltz, Mining Engineering Dept., Jeffrey Mfg. Co., Columbus, Ohio.
Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
T. W. Dawson, Chief Engr., H. C. Frick Coke Co., Scottdale, Pa.
Thos. G. Fear, Genl. Supt., Inland Collieries Co., Indianola, Pa.
Chas. Gottschalk, Cons. Engr., Evansville, Indiana.
Glen A. Knox, Supt., Gunn-Quealy Co., Gunn, Wyoming.
E. F. Miller, Genl. Supt., Bertha-Consumers Co., Rachel, W. Va.
Edw. B. Raiguel, Cons. Engr., First Natl. Bank Bldg., Huntington, W. Va.
D. A. Stout, Chief Engineer of Mines, Fuel Dept., Colorado Fuel & Iron Co., Pueblo, Colo.
W. D. Turnbull, Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
J. D. Zook, Vice-Pres., Illinois Coal Corpn., Chicago, Ill.

SUB-COMMITTEE NO. 3—METHODS OF MINING WITH MECHANICAL LOADING

G. B. Southward (*Chairman*), Coal Service Corporation, Elkins, W. Va.
A. R. Anderson, Jeffrey Mfg. Co., Columbus, Ohio.
D. J. Carroll, Chicago, Wilmington & Franklin Coal Co., Chicago, Ill.
Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
Clarence R. Claghorn, Cons. Mng. Engr., 715 Continental Bldg., Baltimore, Md.
E. H. Coxe, Cons. Engr., Uniontown, Pa.
S. W. Farnham, Goodman Mfg. Co., Chicago, Ill.
E. H. Johnson, The Coloder Co., Columbus, Ohio.
R. G. Lawry, Contracting Engr., Roberts & Schaefer Co., Chicago, Ill.
Rex Martin, Link-Belt Co., Chicago, Ill.
E. S. McKinlay, Pres., McKinlay Mining & Loading Machine Co., Pt. Pleasant, W. Va.
Cecil W. Smith, Chief Engr., Illinois Coal Corpn., Chicago, Ill.
Walter Stevens, Supt., Raleigh-Wyoming Coal Co., Glen Rogers, W. Va.
F. W. Whiteside, Chief Engineer, Victor-American Fuel Co., Denver, Colo.
F. G. Wilcox, Pres.. West End Coal Co., Mears Bldg., Scranton, Pa.
R. Y. Williams, Chf. Engr., Weston Dodson & Co., Inc., Shenandoah, Pa.

SUB-COMMITTEE NO. 4—CUTTING MACHINES

Carl Scholz (*Chairman*), Raleigh-Wyoming Coal Co., Charleston, W. Va.
E. K. Bowers, Asst. Treas., Morgan-Gardner Elec. Co., Chicago, Ill.
Walter Calverley, Pres., W. R. Calverley, Inc., Clarion, Pa.
Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
J. M. Clark. Vice-Pres., Clark & Krebs, Inc., Charleston, W. Va.
R. L. Cox, Jeffrey Mfg. Co., Charleston, W. Va.
Wm. E. Hamilton, Mgr., Hamilton Engineering Co., Columbus, Ohio.
E. S. McKinlay, Pres., McKinlay Mining & Loading Machine Co., Pt. Pleasant, W. Va.
M. C. Mitchell, Mgr., Sullivan Machinery Co., Rwy. Exchange Bldg., St. Louis, Mo.

Mine Drainage

I. A. Malady, *Chairman*

SUB-COMMITTEE NO. 1—PUMPS FOR DEVELOPMENT WORK

L. W. Householder (*Chairman*), Chf. Engr., Rochester & Pittsburgh Coal & Iron Co., Indiana, Pa.
E. F. Austin, Dravo-Doyle Co., Pittsburgh, Pa.
Herbert Axford, Sales Engr., Ingersoll-Rand Co., 610 Spruce St., Scranton, Pa.
J. H. Edwards, Associate Editor, Coal Age, 2962 Winters Rd., Huntington, W. Va.
F. J. Emeny, Vice Pres., The Deming Co., Salem, Ohio.
J. E. Holveck, Dist. Mgr., Aldrich Pump Co., 1209 Empire Bldg., Pittsburgh, Pa.
G. E. Huttle, Mech. Engr., H. C. Frick Coke Co., Scottdale, Pa.
Chas. H. Matthews, Genl. Engr. in Chg. Mining Section, Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
H. J. Nelms, Genl. Supt., New Field By-Products Coal Co., North Bessemer, Pa.
F. W. Smith, Hydroelectric Pump & Supply Co., Curry Bldg., Pittsburgh, Pa.

SUB-COMMITTEE NO. 2—PERMANENT PUMPING STATIONS

Parker Cott (*Chairman*), Salesman, Coal Mine Equipment Co., 2218 Farmers Bank Bldg., Pittsburgh, Pa.
Herbert Axford, Sales Engr., Ingersoll-Rand Co., 610 Spruce St., Scranton, Pa.
Henry E. Cole, Vice Pres., Harris Pump & Supply Co., 320 Second Ave., Pittsburgh, Pa.
J. P. Heidenreich, Asst. Genl. Mgr., Scranton Pump Co., Scranton, Pa.
W. L. Robison, Vice Pres., Youghiogheny & Ohio Coal Co., 1230 Hanna Bldg., Cleveland, O.
R. F. Roth, Emmons Coal Mining Co., Altoona, Pa.
Cecil W. Smith, Chf. Engr., Illinois Coal Corpn., 1380 Old Colony Bldg., Chicago, Ill.
M. Spillman, Works Engr., Worthington Pump & Machinery Corpn., Harrison, N. J.
L. D. Tracy, Supt., U. S. Bureau of Mines, 312 Ceramics Bldg., Urbana, Ill.

SUB-COMMITTEE NO. 3—NATURAL DRAINAGE

John Brunschwyler (*Chairman*), Div. Supt., Boomer Coal & Coke Co., Boomer, W. Va.
M. C. Benedict, Cons. Engr., Brown Equipment Co., 940 Ash St., Johnstown, Pa.
Oscar Cartlidge, Cons. Engr., 1593 Lee St., Charleston, W. Va.
L. P. Crecelius, Engr., Cleveland & Western Coal Co., 1517 Union Trust Bldg., Cleveland, Ohio.
E. D. Knight, 2207 Washington St., Charleston, W. Va.
R. Y. Wert, Supt., Durham Coal & Iron Co., Soddy, Tenn.

SUB-COMMITTEE NO. 4—UNWATERING ABANDONED WORKINGS

Prof. John W. Hallock (*Chairman*), Head of Department of Industrial Engineering, University of Pittsburgh, Pittsburgh, Pa.
G. E. Huttle, Mech. Engr., H. C. Frick Coke Co., Scottdale, Pa.
J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., Pittsburgh, Pa.
O. M. Pruitt, Pres., Indiana Air Pump Co., Indiana Pythian Bldg., Indianapolis, Ind.
Chas. A. Straw, Cons. Mech. Engr., Hudson Coal Co., 434 Wyoming Ave., Scranton, Pa.
G. V. Woody, Mgr., Allis-Chalmers Mfg. Co., Wilkes-Barre, Pa.

SUB-COMMITTEE NO. 5—MINE WATER AND ITS ACTION UPON MINE DRAINAGE EQUIPMENT

Geo. A. Drysdale (*Chairman*), Metallurgical Editor, Foundry, Penton Publishing Co., Cleveland, Ohio.
M. L. Bettcher, Production Engr., The Duriron Co., Inc., Dayton, Ohio.
J. R. Campbell, Hudson Coal Co., Scranton, Pa.
Geo. Watkin Evans, Cons. Coal Mng. Engr., L. C. Smith Bldg., Seattle, Wash.
Carl J. Fletcher, Vice Pres., Knox Coal Mng. Co., Merchants Bank Bldg., Indianapolis, Ind.
C. L. Harrod, Elec. Engr., Indiana Coal Opns. Power Assn., 1509 Merchants Bank Bldg., Indianapolis, Ind.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
Frank G. Morris, Genl. Supt. of Mines, Republic Iron & Steel Co., Sayreton, Ala.
L. D. Rover, Power & Construction Dept., Ford Motor Co., Detroit, Mich.
W. H. Waddington, Sales Engr., Driver-Harris Co., Harrison, N. J.

Mine Ventilation

C. H. Trik, *Chairman*

SUB-COMMITTEE NO. 1—AIR SHAFTS AND AIR WAYS

J. C. Gaskill (*Chairman*), Asst. Cons. Engr., Consolidation Coal Co., Fairmont, W. Va.
C. H. Beidenmiller, Mgr., Glogora Coal Co., 705 First Natl. Bank Bldg., Huntington, W. Va.
J. H. Doughty, Mech. Engr., Lehigh & Wilkes-Barre Coal Co., 16 So. River St., Wilkes-Barre, Pa.
Robert Wallace, Supt., Pocahontas Fuel Co., Inc., Pocahontas, Va.
Jos. J. Walsh, Secretary of Mines, Pennsylvania Dept. of Mines, Harrisburg, Pa.

SUB-COMMITTEE NO. 2—MINE FAN INSTALLATION

G. E. Lyman (*Chairman*), Genl. Supt., Madison Coal Corpn., Glen Carbon, Ill.
H. G. Conrad, Genl. Mgr., American Coal Mining Co., Bicknell, Ind.
R. B. Fleming, Evansburg Coal Co., Colver, Pa.
E. B. Wagner, Lehigh Valley Coal Co., Wilkes-Barre, Pa.

SUB-COMMITTEE NO. 3—BOOSTER FANS

R. Dawson Hall (*Chairman*), Engineering Editor, Coal Age, 10th Ave. at 36th St., New York City.
Howard N. Eavenson, Pres., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
R. H. Moore, Genl. Mgr., C. A. Hughes & Co., Portage, Pa.
E. N. Zern, Editor, Mining Catalog, Keystone Cons. Publishing Co., 800 Penn Ave., Pittsburgh, Pa.

SUB-COMMITTEE NO. 4—MINE ATMOSPHERE

Thomas Chester (*Chairman*), Cons. Engr., 713 B. Copeland St., Pittsburgh, Pa.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
R. M. Perry, Genl. Supt., Moffat Coal Co., 504 Gas & Elec. Bldg., Denver, Colo.

Outside Coal Handling Equipment

James Needham, *Chairman*

Hubb Bell, Sales Chemist, C. P. Chemical & Drug Co., Inc., 114 Liberty St., New York City.
J. W. Bischoff, Vice Pres. & Genl. Mgr., West Virginia Coal & Coke Co., Elkins, W. Va.
W. G. Duncan, Jr., Supt., W. G. Duncan Coal Co., Greenville, Ky.
H. H. Elkins, Supt. of Mines, Valley Camp Coal Co., St. Clairsville, Ohio.
W. C. Henning, Secretary and Treasurer, A. Leschen & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
M. A. Kendall, Chf. Engr., Stephens-Adamson Mfg. Co., Aurora, Ill.
Rudolf Kudlich, Asst. to Chf. Mech. Engr., U. S. Bureau of Mines, Washington, D. C.
John J. Moore, Dey & Maddock, 82d and Dennison Sts., Cleveland, Ohio.
F. G. Morris, Genl. Supt. of Coal Mines, Republic Iron & Steel Co., Sayreton, Ala.
G. H. Morse, Genl. Supt., Republic Iron & Steel Co., Oliver Bldg., Pittsburgh, Pa.
H. F. Nash, Vice Pres. & Genl. Mgr. of Sales, Oakdale Coal Co., Gas and Electric Bldg., Denver, Colo.
Warren R. Roberts, Pres., Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.
H. D. Smith, Genl. Supt., American Coal Co. of Allegany County, McComas, W. Va.
C. R. Stahl, Asst. to Genl. Mgr., E. E. White Coal Co., Stotesbury, W. Va.
C. Law Watkins, Vice Pres., Pennsylvania Coal & Coke Corpn., Cresson, Pa.
F. W. Whiteside, Chf. Engr., Victor-American Fuel Co., Ernest & Cranmer Bldg., Denver, Colo.

THE LEHIGH COAL AND NAVIGATION COMPANY

Miners and Shippers

OLD COMPANY'S LEHIGH

For Over a Century

1820 ANTHRACITE 1926

"The Best Since 1820"

437 CHESTNUT STREET - PHILADELPHIA, PENNSYLVANIA

Irvington Smelting and Refining Works

Buyers, Smelters and Refiners of
Gold, Silver, Lead, Copper and Platinum
Ores, Sweeps and Bullion
Manufacturers of Copper Sulphate

IRVINGTON :-: NEW JERSEY

NEW YORK OFFICE—Charles Engelhard
Hudson Terminal Building 30 Church Street

Phelps Dodge Corporation

99 JOHN STREET - - NEW YORK

MEMBER COPPER & BRASS RESEARCH ASSOCIATION

Copper

"C ★ Q" Electrolytic "P. D. Co." Casting

Tax, Standardization, Industrial Cooperation, Tariff, Daily, Weekly and Monthly News Service, Etc.

THE AMERICAN MINING CONGRESS
SERVING the INDUSTRY
THE MINING CONGRESS JOURNAL

Organized to meet the needs of the Industry. The offices of the American Mining Congress are at the service of its members. Write to 841 Munsey Building, Washington, D. C.

Stonehouse SIGNS, INC.

Stock and Special Signs, Codes, etc., for Mines

JOHN BOYLE, JR.

Attorney-at-Law

Patents

B. S. IN MINING ENGINEERING AND METALLURGY. SIXTEEN YEARS IN THE EXAMINING CORPS OF THE UNITED STATES PATENT OFFICE.

OURAY BUILDING, WASHINGTON, D. C.

OFFICERS AND COMMITTEES, 1926—(Continued)

Underground Power Transmission
A. B. Kiser, *Chairman*

W. A. Chandler, Elec. Engr., Hudson Coal Co., Scranton, Pa.
Harvey Conrad, Genl. Mgr., American Coal Mng. Co., Bicknell, Ind.
L. C. Ilsley, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
R. L. Kingsland, Genl. Supt., Power and Mechanical Dept., Consolidation Coal Co., Fairmont, W. Va.
Carl Lee, Elec. Engr., Peabody Coal Co., 1652 McCormick Bldg., Chicago, Ill.
Wm. Schott, Cons. Engr., Big Creek Coal Co. Chicago, Ill.
Henry M. Warren, Cons. Engr., Glen Alden Coal Co., 300 Jefferson Ave., Scranton, Pa.

Power Equipment
F. L. Stone, *Chairman*

W. C. Adams, Allen & Garcia, Chicago, Ill.
Graham Bright, Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
Stephen H. Green, Pacific Coast Coal Co., Seattle, Wash.
O. P. Hood, Chf. Mech. Engr., U. S. Bureau of Mines, Washington, D. C.
J. T. Jennings, Power Engr., Philadelphia & Reading Coal & Iron Co., Pottsville, Pa.
R. L. Kingsland, Consolidation Coal Co., Fairmont, W. Va.
M. D. Kirk, Vesta Coal Co., Jones & Laughlin Bldg., Pittsburgh, Pa.
Chas. Legrand, Cons. Engr., Phelps Dodge Corpn., Douglas, Ariz.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
D. C. McKeehan, Chf. Elec., Union Pacific Coal Co., Rock Springs, Wyo.
J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., 2307 First National Bank Bldg., Pittsburgh, Pa.
A. J. Nicht, Jr., Engr., Hoisting Equipment, Allis-Chalmers Mfg. Co., Milwaukee, Wis.
W. C. Shunk, Stonega Coal & Coke Co., Big Stone Gap, Va.
Geo. S. Thompson, Chf. Elec. & Master Mech., Colorado Fuel & Iron Co., Pueblo, Colo.
C. D. Woodward, Chf. Elec. Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.

Mine Timbering

SUB-COMMITTEE NO. 1—GENERAL MINE TIMBERING, SIMPLIFICATION ON GRADES AND NAMES
R. E. Krape, *Chairman*

D. F. Holtman (Chairman), Asst. Director, National Committee on Wood Utilization, Dept. of Commerce.
R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.
R. W. Austin, Austin & Wood, North 3rd St., Clearfield, Pa.
J. R. Crowe, Jr., Pres., Crowe Coal Co., Dwight Bldg., Kansas City, Mo.
R. L. Dyer, Engr., Alabama Fuel & Iron Co., Pioneer Bldg., Birmingham, Ala.
G. A. Knox, Supt., Gunn-Quealy Coal Co., Gunn, Wyoming.
Ernest M. Merrill, Pres., Merrill-Ferguson Engineering Co., 506 Kanawha Bank & Trust Bldg., Charleston, W. Va.
Chas. N. Perrin, Secretary, Blakeslee, Perrin & Darling, 1100 Seneca St., Buffalo, N. Y.
Davis Read, Chief Engr., West Kentucky Coal Co., Sturgis, Ky.
George S. Rice, Chf. Mng. Engr., U. S. Bureau of Mines, Washington, D. C.
J. R. Sharp, care of C. F. Kurtz Co., Rock Island, Ill.
Geo. T. Stevens, Chf. Engr., Clinchfield Coal Corpn., Dante, Va.
Frank A. Young, Chief Engr., St. Louis, Rocky Mountain & Pacific Co., Raton, N. M.

SUB-COMMITTEE NO. 2—PRESERVATION OF MINE TIMBERS

Geo. M. Hunt (*Chairman*), In Charge of Wood Preservation Section, Forest Products Laboratory, Madison, Wis.
R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.
W. L. Affelder, Asst. to Pres., Hillman Coal and Coke Co., 2306 First Natl. Bank Bldg., Pittsburgh, Pa.
R. W. Austin, Austin & Wood, North 3rd St., Clearfield, Pa.
M. E. Haworth, Chief Engr., Hillman Coal & Coke Co., First Natl. Bank Bldg., Pittsburgh, Pa.
M. H. Sellers, Timber Agent, Chicago, Wilmington & Franklin Coal Co., Carbondale, Ill.
D. A. Stout, Chief Engr. of Mines, Fuel Dept., Colorado Fuel & Iron Co., Pueblo, Colo.

SUB-COMMITTEE NO. 3—USE OF CONCRETE IN MINE TIMBERING

Newell G. Alford (*Chairman*), Vice-Pres., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
R. L. Adams, Chief Engineer, Old Ben Coal Corporation, Christopher, Ill.
Jas. R. Barber, Ass't Engineer, St. Louis, Rocky Mountain & Pacific Co., Raton, New Mexico.
D. W. Blaylock, Chief Engineer, Madison Coal Corporation, Glen Carbon, Ill.
Walter Buss, Chief Engineer, Knox Consolidated Coal Co., Vincennes, Indiana.
B. C. Collier, Pres., Cement-Gun Co., Inc., Allentown, Pa.
W. E. Guller, Chief Engr., Donk Bros. Coal & Coke Co., Edwardsville, Ill.
Frank Haas, Cons. Engineer, Consolidation Coal Co., Fairmont, West Va.
Daniel Harrington, Cons. Engr., Newhouse Bldg., Salt Lake City, Utah.
C. T. Hayden, Chief Engineer, Cosgrove-Meehan Coal Corp., Marion, Ill.
Fred J. Hogan, Mining Engineer, Spangler, Pa.
L. W. Householder, Chief Engineer, Rochester & Pittsburgh Coal & Iron Co., Indiana, Pa.
W. R. Peck, Chief Engineer, Black Diamond Collieries Co., Coal Creek, Tenn.
J. C. Quade, Chief Engineer, Saline County Coal Corp., Harrisburg, Ill.
C. E. Swann, Chief Engr., Union Pacific Coal Co., Rock Springs, Wyo.
F. W. Whiteside, Chief Engineer, Victor-American Fuel Co., Denver, Colo.
H. S. Wright, Engineer, Structural Bureau, Portland Cement Ass'n, 33 West Grand Ave., Chicago, Ill.

SUB-COMMITTEE NO. 4—USE OF STRUCTURAL STEEL FOR MINE TIMBERING

J. D. Snyder (*Chairman*), Div. Engr., Consolidation Coal Co., Frostburg, Md.
L. B. Abbott, Chief Engineer, Consolidation Coal Co., Jenkins, Ky.
R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.
D. W. Blaylock, Mng. Engr., Madison Coal Corpn., Glen Carbon, Ill.
J. M. Clark, Jr., Asst. Engr., E. E. White Coal Co., Mt. Hope, W. Va.
R. V. Clay, Wheeling & Lake Erie Coal Mining Co., Cleveland, Ohio.
A. W. Hesse, Chf. Coal Mng. Engr., Youngstown Sheet & Tube Co., Nemacolin, Pa.
Robert A. Marble, Carnegie Steel Co., Carnegie Bldg., Pittsburgh, Pa.
Geo. A. Richardson, Mgr., Technical Publicity Dept., Bethlehem Steel Co., Bethlehem, Pa.
J. A. Saxe, Chief Engineer, Bethlehem Mines Corporation, Heilwood, Pa.
Frank A. Young, Chief Engineer, St. Louis, Rocky Mountain & Pacific Co., Raton, N. M.

SUB-COMMITTEE NO. 5—SALVAGE OF MINE TIMBER

George T. Stevens (Chairman), Chf. Engr., Clinchfield Coal Corpn., Dante, Va.
R. L. Adams, Chf. Engr., Old Ben Coal Corp., Christopher, Ill.
Frank S. Follansbee, Chief Mining Engineer, Woodward Iron Co., Woodward, Ala.
H. F. McCullough, Engr., H. C. Frick Coke Co., Scottdale, Pa.
A. B. Walter, Chf. Engr., O'Gara Coal Co., Harrisburg, Ill.

SUB-COMMITTEE NO. 6—REFORESTATION
(Personnel not yet selected)

METAL MINING BRANCH
General Committee

Charles A. Mitke (*Chairman*), Cons. Mng. Engr., Phoenix, Ariz.
Frank Ayer, Mgr., Moctezuma Copper Co., Nacozari, Sonora, Mexico.
Wm. Conibear, Safety Inspector, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Arthur Crowfoot, Mill Supt., Phelps Dodge Corpn., Morenci, Ariz.
William B. Daly, Genl. Mgr. of Mines, Anaconda Copper Mining Co., 504 Hennessy Bldg., Butte, Mont.
Lucien Eaton, Supt., Ishpeming District, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Wm. H. Gallagher, Jr., Chf. Mng. Engr., Pickands-Mather & Co., 700 Sellwood Bldg., Duluth, Minn.
H. C. Goodrich, Chf. Engr., Utah Copper Co., Kearns Bldg., Salt Lake City, Utah.
T. O. McGrath, Mgr., Shattuck-Denn Mng. Corp., Bisbee, Ariz.
Dr. Frank H. Probert, Dean, College of Mining, University of California, Berkeley, Calif.
Philip D. Wilson, American Metal Co., Ltd., 61 Broadway, New York City.

Mine Drainage
Wm. H. Gallagher, Jr., *Chairman*

H. T. Abrams, Dept. Mgr. of Air Lift Pumps and "Calyx" Drills, Ingersoll-Rand Co., 11 Broadway, New York City.
G. L. Kollberg, Mgr., Pumping Engine Dept., Allis-Chalmers Mfg. Co., Milwaukee, Wis.
O. D. McClure, Chief Mech. Engr., Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Charles Mendelsohn, Master Mechanic, Old Dominion Company, Globe, Ariz.
W. A. Rankin, Elec. Engr., Copper Range Company, Painesdale, Mich.
W. N. Tanner, Chief Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.
C. D. Woodward, Chief Elec. Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.

Drilling Machines and Drill Steel
Frank Ayer, *Chairman*

SUB-COMMITTEE NO. 1—DRILLING MACHINES

B. F. Tillson (*Chairman*), Asst. Supt., New Jersey Zinc Co., Franklin, N. J.
L. C. Bayles, Designing Engr., Rock Drill Dept., Ingersoll-Rand Co., Phillipsburg, N. J.
Arthur B. Foote, Genl. Mgr., North Star Mines Co., Grass Valley, California.
J. A. Fulton, Idaho-Maryland Mines Co., Grass Valley, California.
Roy H. Marks, Efficiency Engr., United Verde Extension Mng. Co., Jerome, Arizona.
R. T. Murrill, Efficiency Engr., St. Joseph Lead Co., Rivermines, Mo.
R. A. Scott, Sales Mgr., Denver Rock Drill Mfg. Co., 39th and Williams St., Denver, Colo.
W. C. Scott, Supt., Morenci Branch, Phelps Dodge Corpn., Metcalf, Ariz.
George A. Shaw, Mine Supt., Talache Mines, Inc., Talache, Idaho.
H. T. Walsh, Vice Pres., Sullivan Machinery Co., Peoples Gas Bldg., Chicago, Ill.

SUB-COMMITTEE NO. 2—DRILL STEEL

Norman B. Braly, Genl. Mgr., North Butte Mng. Co., Butte, Mont.
E. G. Deane, Mgr., Superior & Boston Copper Co., Copper Hill, Ariz.
O. J. Egleston, Mgr., U. S. Smelting, Refining & Mining Co., Kennett, Calif.
C. S. Elayer, Cloudcroft, New Mexico.
E. F. Hastings, Salesman, Ingersoll-Rand Co. of Texas, Dominion Hotel, Globe, Ariz.
Chas. S. Hurter, Tech. Representative, E. I. du Pont de Nemours & Co., Inc., 5104 Du Pont Bldg., Wilmington, Del.
Charles B. Officer, Asst. to Pres., Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.
Henry S. Potter, Managing Director, Henry S. Potter, Ltd., 26 Cullinan Bldg., Johannesburg, South Africa.
Ocha Potter, Supt., Ahmeek-Kearsarge Br., Calumet & Hecla Mng. Co., Ahmeek, Mich.
Chas. A. Smith, Asst. Genl. Mgr., Ray Consolidated Copper Co., Ray, Ariz.
A. S. Uhler, Mgr., Rock Drill Sales, Ingersoll-Rand Co., 11 Broadway, New York City.
M. van Sicien, Engr., In Charge of Mining Research, U. S. Bureau of Mines, Washington, D. C.
Bruce C. Yates, Supt., Homestake Mining Co., Lead, South Dakota.

SUB-COMMITTEE NO. 3—METHODS OF SHARPENING DRILL STEEL

W. R. Wade (Chairman), Cons. Engr., 1230 Geary St., San Francisco, Calif.
George H. Gilman, Pres., Gilman Mfg. Co., E. Boston, Mass.
Chas. E. Lees, Cia Minera Asarco, S. A., Unidad Veta Grande, Apartado Num, 85, Parral, Chih., Mexico.
Frank W. McLean, United Verde Copper Co., Jerome, Ariz.
W. H. Schacht, Genl. Mgr., Copper Range Co., Painesdale, Mich.
H. W. Seamon, Supt., Comstock Merger Mines, Inc., Virginia City, Nevada.

Underground Transportation
William B. Daly, *Chairman*

Thos. C. Baker, Genl. Mgr., The Comstock Merger Mines Co., Virginia City, Nevada.
George H. Booth, Mech. Engr., Inspiration Cons. Co., Inspiration, Arizona.
R. R. Boyd, 616 Foothill Rd., Beverly Hills, California (C. C. M. Oil Co.)
D. S. Calland, Managing Director, Compania de Real del Monte de Pachuca, Pachuca, Hidalgo, Mexico.
W. R. Crane, Supt., Southern Station, U. S. Bureau of Mines, New Federal Bldg., Birmingham, Alabama.
W. Val DeCamp, Genl. Mine Supt., United Verde Copper Co., Jerome, Arizona.
Robert H. Dickson, Mgr., Verde Central Mines, Inc., Jerome, Arizona.
Stanly A. Easton, Mgr., Bunker Hill & Sullivan Mng. & Concentrating Co., Kellogg, Idaho.
H. T. Hamilton, Cons. Mng. Engr., 1408 California Commercial Union Bldg., San Francisco, California.
F. H. Hayes, Mine Supt., Copper Queen Branch, Phelps Dodge Corpn., Bisbee, Arizona.
R. E. Howe, Genl. Supt., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.
C. A. Lantz, Genl. Mgr., Compania de Santa Gertrudis, S. A., Apartado No. 1, Pachuca, Hidalgo, Mexico.
E. M. Norris, Asst. Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
Thomas K. Scott, Supt., Munro Iron Mining Co., Iron River, Mich.
Andover Syverson, Prescott, Arizona.

Fire-Fighting Equipment
Wm. Conibear, *Chairman*

SUB-COMMITTEE NO. 1—CONTROL OF VENTILATING EQUIPMENT DURING MINE FIRES

Orr Woodburn (*Chairman*), Director, Globe-Miami District, Mine Rescue and First Aid Assn., Globe, Ariz.
Guy J. Johnson, Field Representative, Homestake Mng. Co., Lead, South Dak.
H. J. Rahilly, Asst. Genl. Supt., Original Stewart, Colorado Mines, Anaconda Copper Mining Co., Butte, Mont.

The United States Bureau of Engraving and Printing ©*Harris & Ewing*

THE MINING CONGRESS JOURNAL brings to you each month a complete and comprehensive survey of all legislative and departmental activities in Washington affecting mining.

LEADERS of the industry use the pages of The Mining Congress Journal to present their viewpoint relative to outstanding problems confronting the industry. These articles are of particular value to all mining men.

THE EDITORIALS are a strong, fearless expression of the attitude of mining men in regard to public policy.

SPECIAL MONTHLY ARTICLES devoted to Taxation, Transportation and Standardization give your operating men a direct contact through The Mining Congress Journal with matters affecting their daily problems.

Vigorous and well balanced, The Mining Congress Journal renders service to you and to the industry.

***Read the* MINING CONGRESS JOURNAL**

Keep in Touch with Washington

OFFICERS AND COMMITTEES, 1926—(Concluded)

Albert Tallon, Safety Inspector, The Old Dominion Co., Globe, Ariz.
J. T. Young, Safety Inspector, Arizona Copper Company, Morenci, Ariz.

SUB-COMMITTEE NO. 2—FIRE HOSE

R. H. Seip (*Chairman*), New Jersey Zinc Co., Franklin, N. J.
C. W. Moon, Safety Inspector, Phelps Dodge Corpn., Bisbee, Ariz.
B. O. Pickard, District Engineer, U. S. Bureau of Mines, Berkeley, Calif.

Mining Excavating Equipment—Exclusive of Dredges

H. C. Goodrich, *Chairman*

H. G. S. Anderson, Mng. and Met. Engr., Rolla, Mo.
H. C. Bellinger, Vice Pres., Chile Exploration Co., 25 Broadway, New York City.
Michael Curley, Genl. Supt., New Cornelia Copper Co., Ajo, Ariz.
H. T. Gracely, Adv. Mgr., Marion Steam Shovel Co., Marion, Ohio.
C. B. Lakenan, Genl. Mgr., Nevada Cons. Copper Co., McGill, Nev.
W. J. Lester, Pres., Kentucky Washed Coal Co., Greenville, Ky.
C. H. Matthews, Genl. Engineering Dept., Westinghouse Mlec. & Mfg. Co., E. Pittsburgh, Pa.
Geo. Mieyr, Supt., Sacramento Hill, Copper Queen Branch, Phelps Dodge Corpn., Bisbee, Ariz.
G. A. Murfey, Treas. and Chief Engr., The Browning Co., 16226 Waterloo Rd., Cleveland, Ohio.
Henry B. Oatley, Vice Pres., Superheater Co., 17 E. 42nd St., New York City.
Thos. A. Snyder, Bucyrus Co., South Milwaukee, Wis.
Robt. E. Tally, Genl. Mgr., United Verde Copper Co., Jerome, Ariz.
J. C. Wheat, Development Engr., Industrial Works, Bay City, Mich.
Charles S. Whitaker, Vice Pres., Winston Bros. Co., 801 Globe Bldg., Minneapolis, Minn.

Mine Ventilation

Chas. A. Mitke, *Chairman* (*Temporary*)

Robt. N. Bell, Cons. Mng. Engr., Box 1339, Boise, Idaho.
Walter C. Browning, Cons. Engr., 1215 Pacific Mutual Bldg., Los Angeles, Calif.
O. K. Dyer, Mgr., Small Blower Dept., Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Daniel Harrington, 507 Newhouse Bldg., Salt Lake City, Utah.
E. T. Lednum, Mgr., E. I. du Pont de Nemours & Co., Inc., 406 Ideal Bldg., Denver, Colo.
C. E. Legrand, Cons. Engr., Phelps Dodge Corpn., Douglas, Ariz.
F. W. Maclennan, Genl. Mgr., Miami Copper Co., Miami, Ariz.
Don M. Rait, Supt. of Mines, Calumet and Arizona Mining Co., Warren, Ariz.
A. S. Richardson, Ventilation Engr., Anaconda Copper Mining Co., Butte, Mont.
Wm. A. Rowe, Chief Engr., American Blower Co., 6004 Russell St., Detroit, Mich.
A. C. Stoddard, Chief Mine Engr., Inspiration Cons. Copper Co., Inspiration, Ariz.
F. L. Stone, Industrial Engineering Dept., General Electric Co., Schenectady, N. Y.
E. B. Williams, Mgr., Marine Dept., B. F. Sturtevant Co., Hyde Park, Boston, Mass.

Mechanical Loading Underground

Lucien Eaton, *Chairman*

SUB-COMMITTEE NO. 1—LOADING MACHINES FOR TUNNELS, LARGE DRIFTS AND STOPES

Douglas C. Corner (*Chairman*), St. Louis Power Shovel Co., 320 Chemical Bldg., St. Louis, Mo.
H. E. Billington, Vice Pres. for Sales, The Thew Shovel Co., Lorain, Ohio.
J. H. Hensley, Mine Supt., Miami Copper Co. Miami, Ariz.
H. DeWitt Smith, New York Trust Co., 100 Broadway, New York City.
H. G. Washburn, Asst. Genl. Mgr., Federal Mng. & Smelting Co., Wallace, Idaho.
William Whaley, Genl. Mgr., Myers-Whaley Co., Knoxville, Tenn.

SUB-COMMITTEE NO. 2—LOADING MACHINES FOR SMALL DRIFTS AND FOR WORK ON SUB-LEVELS

G. R. Jackson (*Chairman*), Supt., Cleveland-Cliffs Iron Co., Negaunee, Mich.
C. L. Berrien, Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
H. H. Talboys, Mgr., Shuveloder Dept., Nordberg Mfg. Co., Milwaukee, Wis.
Chas. E. Van Barneveld, Chatsworth, Calif.

SUB-COMMITTEE NO. 3—SCRAPERS

Lucien Eaton (*Chairman*), Supt., Ishpeming District, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
C. L. Kohlhaas, Denver Rock Drill Co., Duluth, Minn.
Ward Royce, Ingersoll-Rand Co., Duluth, Minn.
E. E. Whiteley, Asst. Mgr., Calumet & Arizona Mining Co., Warren, Ariz.

Mine Timbering

Frank H. Probert, *Chairman*

SUB-COMMITTEE NO. 1—PRESERVATION OF MINE TIMBERS

Geo. M. Hunt (*Chairman*), In Charge of Section of Wood Preservation, Forest Products Laboratory, Madison, Wis.
J. H. Hensley, Miami Copper Co., Miami, Ariz.
Gerald Sherman, Cons. Mng. Engr., Phelps Dodge Corpn., Douglas, Ariz.

SUB-COMMITTEE NO. 2—GUNITE AS A SUBSTITUTE FOR TIMBER, ITS PROPER APPLICATIONS AND ITS LIMITATIONS

E. M. Norris (*Chairman*), Asst. Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
B. C. Collier, Pres., Cement-Gun Co., Inc., Allentown, Pa.
R. R. Horner, Cons. Engr., U. S. Bureau of Mines, Clarksburg, W. Va.

SUB-COMMITTEE NO. 3—DETERMINATION OF SIZE AND SHAPE OF DRIFTS AND DRIFT TIMBERS FOR VARIOUS PURPOSES, WITH A VIEW TO REDUCING SAME TO CERTAIN STANDARD SIZES AND SHAPES

Dr. F. W. Sperr (*Chairman*), Professor of Civil and Mining Engineering, Michigan College of Mines, 315 Florence St., Houghton, Mich.
C. L. Berrien, Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
Felix McDonald, Mines Supt., Inspiration Cons. Copper Co., Inspiration, Ariz.

SUB-COMMITTEE NO. 4—COOPERATION BETWEEN OPERATORS AND LUMBER DEALERS AND MANUFACTURERS, WITH A VIEW TO ASCERTAINING WHETHER FURTHER STANDARDIZATION IN SIZES AND SHAPES OF LUMBER UNDERGROUND WOULD RESULT IN A REDUCTION IN COST TO MINING COMPANIES

Charles F. Willis (*Chairman*), Editor and Publisher, Arizona Mining Journal, Phoenix, Ariz.
W. S. Boyd, Genl. Mgr., Ray Cons. Copper Co., Ray, Ariz.
T. Evans, Genl. Mgr., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.
D. F. Holtman, Asst. Director, National Committee on Wood Utilization, Department of Commerce.
G. R. Jackson, Supt., Negaunee Mine, Cleveland-Cliffs Iron Co., Negaunee, Mich.
W. G. McBride, Genl. Mgr., Old Dominion Co., Globe, Ariz.

Mine Accounting

T. O. McGrath, *Chairman*

L. S. Cates, Vice-Pres. and Genl. Mgr., Utah Copper Co., Salt Lake City, Utah.
J. C. Dick, Mng. Engr., 511 Newhouse Bldg., Salt Lake City, Utah.
L. K. Diffenderfer, Secy. and Treas., Vanadium Corporation of America, 120 Broadway, New York City.
H. B. Fernald, Loomis-Suffern & Fernald, 50 Broad St., New York City.
H. H. Miller, General Auditor, Hercules Mining Company, Wallace, Idaho.
H. L. Norton, 27 Pearl St., Medford, Mass.
Harry Vivian, Chief Engr., Calumet & Hecla Cons. Copper Co., Calumet, Mich.

Milling and Smelting Practices and Equipment

Arthur Crowfoot, *Chairman*

SUB-COMMITTEE NO. 1—MILLING PRACTICES AND EQUIPMENT

Arthur Crowfoot (Chairman), Mill Supt., Phelps-Dodge Corpn., Morenci, Ariz.
H. G. S. Anderson, Rolla, Mo.
Herman C. Bellinger, Vice-Pres., Chile Exploration Co., 25 Broadway, New York City.
Allan J. Clark, Supt. of Mills, Homestake Mining Co., Lead, S. Dak.
G. R. Delamater, Fuel Engr., W. S. Tyler Co., Superior St., Cleveland, Ohio.
W. M. Drury, Genl. Mgr., Mining Dept., American Smelting and Refining Co., El Paso, Tex.
Guy H. Ruggles, Mill Supt., Inspiration Cons. Copper Co., Inspiration, Ariz.
Henry A. Tobelmann, Cons. Engr. and Chemist, Associated Industries, 21 E. 40th St., New York City.
William Young Westervelt, Cons. Mng. Engr., 522 Fifth Ave., New York City.

SUB-COMMITTEE NO. 2—SMELTING PRACTICES AND EQUIPMENT

J. Owen Ambler, Smelter Supt., Phelps-Dodge Corpn., Clifton, Ariz.
P. P. Butler, Supt. of Douglas Reduction Works, Phelps-Dodge Corpn., Douglas, Ariz.
Harry A. Clark, Genl. Mgr., Calumet & Arizona Mng. Co., Warren, Ariz.
Kuno Doerr, Genl. Mgr., Southwestern Dept., American Smelting & Refining Co., El Paso, Tex.
F. L. Flynn, Toltec Club, El Paso, Tex.
Professor Carle R. Hayward, Associate Professor of Metallurgy, Mass. Institute of Technology, Cambridge, Mass.
George W. Prince, Asst. Genl. Mgr., United Verde Extension Mining Co., Clemenceau, Ariz.
Forest Rutherford, Cons. Metallurgical Engr., 50 Broad St., New York City.

Methods of Mine Sampling, Methods of Recording Underground Geological Data, and Methods of Estimation of Ore Reserves For Low Medium and High Grade Ore bodies

Philip D. Wilson, *Chairman*

Guy Bjorge, Cons. Mng. Engr., 1400 Hawthorne Terrace, Berkeley Calif.
E. L. Derby, Jr., Chief Geologist, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
M. J. Elsing, Mng. Engr. and Geologist, Warren, Ariz.
Dr. L. C. Graton, Professor of Geology, Harvard University, Cambridge, Mass.
Julius Kruttschnitt, Jr., Mgr., Mining Dept. of the Southwest, American Smelting and Refining Co., Tucson, Ariz.
F. A. Linforth, Asst. Chf. Geologist and Asst. Chf. Mng. Engr., Anaconda Copper Mining Co., 526 Hennessy Bldg., Butte, Mont.
Albert Mendelsohn, Underground Supt., Champion Copper Co., Painesdale, Mich.
MacHenry Mosier, Mine Supt., Morenci Branch, Phelps-Dodge Corp'n., Morenci, Ariz.
Louis E. Reber, Jr., Chf. Geologist, United Verde Copper Co., Jerome, Ariz.
T. Skewes Saunders, Cons. Mng. Engr., Av. Cinco de Mayo 10, Despacho 33, Mexico, D. F.
J. B. Tenney, Bisbee, Ariz.
Robert W. Thomas, Supt. of Mines, Ray Cons. Copper Co., Ray, Ariz.

Joint Publicity Committee

Representing Coal Mining Branch:

Ralph C. Becker, Keystone Consolidated Publishing Co., care McGraw-Hill Publishing Co., 10th Ave. at 36th St., New York City.
C. H. Trik, Sales and Mine Ventilation Engr., Jeffrey Mfg. Co., Columbus, Ohio.

Representing Metal Mining Branch:

T. O. McGrath, Asst. Mgr., Shattuck-Arizona Copper Co., Bisbee, Ariz.
Charles F. Willis, Editor and Publisher, Arizona Mining Journal, Phoenix, Ariz.

COMMITTEES

COOPERATION

AMERICAN MINING CONGRESS AND AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

A. M. C.

A. Cressy Morrison, 30 E. 42nd St., New York City.
J. E. Spurr, Hill Bldg., New York City.
W. R. Ingalls, 115 Broadway, New York City.
J. R. Finlay, 170 Broadway, New York City.
Daniel B. Wentz, Land Title Bldg., Philadelphia, Pa.

A. I. M. & M. E.

E. P. Mathewson, 42 Broadway, New York City
W. L. Saunders, 11 Broadway, New York City.
Walter Douglas, 99 John St., New York City.
Benjamin B. Thayer, 25 Broadway, New York City.
Samuel Taylor, Second National Bank Bldg., Pittsburgh, Pa.

ALASKAN AFFAIRS

John A. Davis, U. S. Bureau of Mines, Washington, D. C.
Falcon Joslin, 2208 L. C. Smith Bldg., Seattle, Wash.
Bart L. Thane, 408 Crocker Bldg., San Francisco, Calif.

MINING IN FOREIGN COUNTRIES

J. E. Spurr, *Chairman*, Hill Bldg., New York City.
Van H. Manning, 15 West 44th St., New York City.
E. L. Doheny, 120 Broadway, New York City.
W. J. Loring, Merchants National Bank Bldg., Los Angeles, Calif.
Matthew C. Fleming, New York City.
H. Foster Bain, 29 W. 39th St., New York City.

ADVISORY COMMITTEE UNITED STATES BUREAU OF MINES AND GEOLOGICAL SURVEY

Bulkeley Wells, *Chairman*, San Francisco, Calif.
Walter Douglas, New York City.
Rembrandt Peale, New York City.
H. Foster Bain, 29 W. 39th St., New York City.
George Otis Smith, U. S. Geological Survey, Washington, D. C.

COOPERATION INTERNAL REVENUE DEPARTMENT

J. F. Callbreath, American Mining Congress, Munsey Bldg., Washington, D. C.
John T. Barnett, 1024 Lafayette St., Denver, Colo.
Paul Armitage, 2174, 233 Broadway, New York City.
L. C. Boyle, Kansas City, Mo.
Rush C. Butler, Chicago, Ill.

OPERATORS' CO-OPERATING COMMITTEE

J. G. Bradley, *Chairman*
J. F. Callbreath, *Secretary*

PETROLEUM

E. L. Doheny, Mexican Petroleum Co., 120 Broadway, New York City.

George S. Davidson, Gulf Refining Co., Pittsburgh, Pa.
A. L. Beaty, Texas Co., 17 Battery Pl., New York City.
H. F. Sinclair, Sinclair Oil Co., 45 Nassau St., New York City.
Walter Teagle, Standard Oil Co. of N. J., New York City.

METALS

Bulkeley Wells, Hobart Bldg., San Francisco, Calif., Gold.
F. B. Richards, Leader-News Bldg., Cleveland, Ohio, Iron.
Edgar Z. Wallower, Joplin, Mo., Zinc.
B. B. Thayer, 25 Broadway, New York City, Copper.

COAL

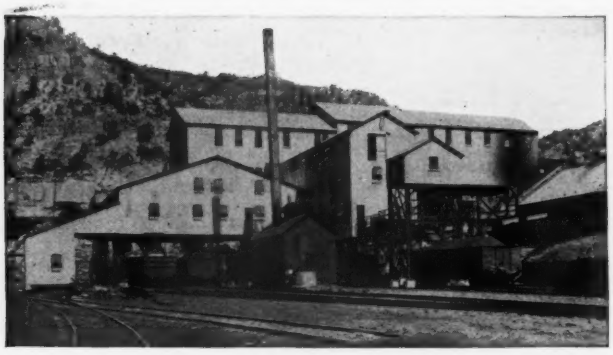
J. G. Bradley, Elk River Coal & Lumber Co., Dundon, W. Va.
T. H. Watkins, Pennsylvania Coal & Coke Corp., New York City.
E. W. Parker, Anthracite Bureau of Information, Philadelphia, Pa.
Albert Nason, Nason Coal Co., Chicago, Ill.

COAL EXPORTS

Geo. S. Rice, Bureau of Mines, Washington, D. C.
John Callahan, Woodward Bldg., Washington, D. C.
Chas. A. Owen, Pres., Imperial Coal Corporation, 17 Battery Pl., New York City.
G. A. O'Reilly, Irving National Bank, New York City.
J. G. Puterbaugh, McAlester Fuel Co., McAlester, Okla.
S. D. Warriner, Lehigh Coal & Navigation Co., Philadelphia, Pa.

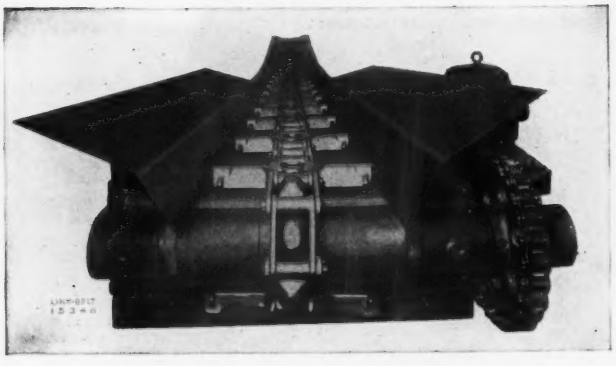
INDEX TO ADVERTISERS

	Page
Allis-Chalmers Mfg. Co.	13
Ameling Bros. Co., Inc., H. R.	21
American Rheolaveur Co.	9
American Steel & Wire Co.	10
Atlas Powder Co.	19
A. M. Byers Co.	6
Boyle, John, Jr.	27
Car Dumper & Equipment Co.	25
Centerville Foundry & Mfg. Co.	10
The Central Frog & Switch Co.	19
Connellsville Mfg. & Mine Supply Co.	23
Diamond Machine Co.	23
Dravo-Doyle Co.	25
DuPont de Nemours & Co., Inc., E. I.	14
Ellis Mill Co.	25
Enterprise Wheel & Car Corp.	21
Fawcus Machine Co.	23
General Coal Co.	15
Goodman Mfg. Co.	(Inside Front Cover)
Hendrick Mfg. Co.	23
Hercules Powder Co.	3
Hoffman Brothers	21
Howells Mining Drill Co.	25
Ingersoll-Rand Co.	7
Irvington Smelting & Ref. Works	27
Jeffrey Mfg. Co., The	4
Keystone Churn Drill Co.	21
Keystone Lubricating Co.	25
Lehigh Coal & Navigation Co.	27
A. Leschen & Sons Rope Co.	25
Linde Air Products Co.	17
Link-Belt Co.	32
Mining Safety Device Co.	25
Morse Chain Co.	(Back Cover)
Mott Core Drilling Co.	21
Ohio Brass Co.	23
R. S. Patrick	21
Phelps Dodge Corp.	27
Robinson Ventilating Co.	13
Roebling's Sons Co., John A.	8
Stonehouse Signs, Inc.	27
Thorne Neale & Co., Inc.	15
United Filters Corp.	25
Vulcan Iron Works	11
West Virginia Rail Co.	19



The Link-Belt Tipple of the Spring Canyon Coal Co., Spring Canyon, Utah.

The Link-Belt Washery of the Consolidated Coal Co., of St. Louis. Mine No. 7, Staunton, Ill.



One of several types of Face Conveyors designed and installed by Link-Belt Company.

Our engineers will gladly assist with their experience, aided by the manufacturing facilities of this company, in creating for YOU, a Tipple, Washery, or Underground Conveying System that is simple, effective, economical.

Write nearest office

LINK-BELT COMPANY 2739

Leading manufacturers of Elevating, Conveying, and Power Transmission Chains and Machinery.

PHILADELPHIA.....2045 Hunting Park Ave.	CHICAGO.....300 W. Pershing Road	INDIANAPOLIS.....200 S. Belmont Ave.
Pittsburgh.....335 Fifth Ave.	Wilkes-Barre.....826 2nd National Bank Bldg.	Denver.....520 Boston Bldg.
St. Louis.....3638 Olive St.	Huntington, W. Va.....Robson-Prichard Bldg.	Birmingham, Ala.....720 Brown-Marx Bldg

LINK-BELT

STANDARDIZATION DIVISION,
The American Mining Congress,
841 Munsey Building,
Washington, D. C.

I am enclosing.....for.....copies of the Handbook of Standard and Approved American Coal Mining Methods, Practice Equipment—each order to include a subscription to The Mining Congress Journal.

Name .....

Street .....

City..... **State**.....

IMPORTANT SUBJECTS TREATED in the Handbook of Standard and Approved American Coal Mining Practice include: basic rules safeguarding electricity in mines; electric tipple equipment; underground stations (in fact all phases of automatic control of mine equipment); trolley and storage battery types locomotives; mine tracks, signals, and switches, including track gauge, turnouts, frogs and switches; mine cars; mine fans, airways and shafts and booster fans; wire rope, ladders, and miscellaneous coal handling equipment; pumps for development work, permanent pumping stations, natural drainage, and effect of mine water on equipment; loading machines, belt, chain and shaking conveyors, installing and operating cutting and loading equipment; general mine timbering, preservation of timbers, and use of concrete and steel.

Tested From Every Angle

No ordinary tests were sufficient to give the subjects treated in this handbook their authoritative character. In every detail it is the result of an exhaustive effort, drawn from nation-wide experience and research—an effort covering more than five years on the part of leaders in all phases of the industry—operators, engineers, and equipment manufacturers. And every subject is packed with suggestions that help combine safety and efficiency with low cost.

This book is pocket size and is loose-leaf so that it can be kept up to date as recommendations are approved.

The price of this book is $5.00. This includes a subscription to THE MINING CONGRESS JOURNAL, which carries each month a department of practical operating problems.

STANDARDIZATION DIVISION

The American Mining Congress

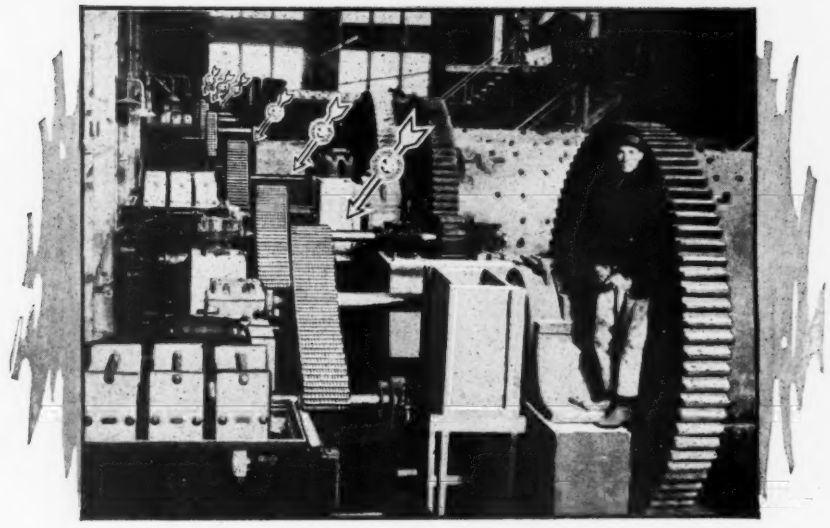
841 MUNSEY BUILDING

WASHINGTON, D. C.

To put economy on a thoroughly scientific basis and to crop unnecessary expense from every phase of the mining process fill out the coupon and send it today.

MORSE SILENT CHAIN DRIVES

THE MORSE "ROCKER JOINT"



100 H. P. Morse Silent Chains driving Tube Mills at Canada Copper Co., Allenby, B. C., Canada

Chained Power can't get away

Especially when Morse Silent Chain Drives are used. They guarantee the continuous and dependable operation of equipment so essential to safe and economical production. They are 98.6% efficient, positive, flexible, ideal for short centers.

Over 5,000,000 H. P. installed and many still in use after many years of service. One-tenth to 5,000 H. P., 6,000 to 250 r. p. m. and slower.

Transmission Engineers, with years of experience in correctly applying the drive to the job, are always ready to serve you. Address the nearest office.

MORSE CHAIN CO., ITHACA, N. Y., U.S.A.

ATLANTA, GA., 702 Candler Bldg., Earl F. Scott & Co.
BALTIMORE, MD.....1402 Lexington Bldg.
BIRMINGHAM, ALA..Moore-Handley Hdw. Co.
BOSTON, MASS.....141 Milk St.
BUFFALO, N. Y.....Ellicott Square Bldg.
CHARLOTTE, N. C..404 Commercial Bk. Bldg.
CHICAGO, ILL.....112 W. Adams St.
CLEVELAND, OHIO.....421 Engineers Bldg.
DENVER, COLO.....211 Ideal Bldg.
DETROIT, MICH.....7601 Central Ave.
LOUISVILLE, KY., 51 W. Main St., E. D. Morton Co.
MINNEAPOLIS, MINN., 413 Third St., Strong-Scott Mfg. Co.
NEW ORLEANS, LA., Queen & Crescent Bldg., 334 Camp St., A. M. Lockett & Co., Ltd.
NEW YORK, N. Y.....50 Church St.
OMAHA, NEB., 727 W. O. W. Bldg., D. H. Braymer Equipt. Co.
PHILADELPHIA, PA...803 Peoples Bk. Bldg.
PITTSBURGH, PA.....Westinghouse Bldg.
SAN FRANCISCO, CALIF...Monadnock Bldg.
ST. LOUIS, MO.....2137 Ry. Exchange Bldg.
TORONTO, 2, ONT., CAN...50 Front St., E., Strong-Scott Mfg. Co.
WINNIPEG, MAN., CAN.....Dufferin St., Strong-Scott Mfg. Co.

1254

RANSDELL INCORPORATED, PRINTERS, WASHINGTON, D. C.